PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2002-014211

(43)Date of publication of application : 18.01.2002

(51)Int.Cl. G02B 5/08
G02B 5/02
G02F 1/1335

(21)Application number : 2001-116619

(22)Date of filing : 16.04.2001

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(30)Priority

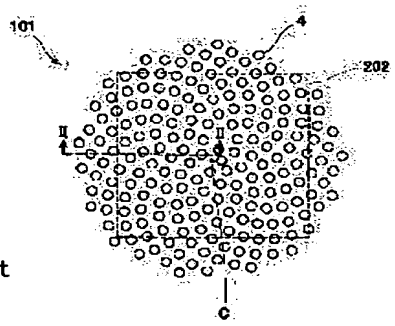
Priority number : 2000122728 Priority date : 24.04.2000 Priority country : JP

(54) REFLECTOR, REFLECTION TYPE LIQUID CRYSTAL DISPLAY DEVICE, ITS MANUFACTURING METHOD, OPTICAL MEMBER, DISPLAY DEVICE, ILLUMINATOR AND WAVE MEMBER

(57)Abstract:

PROBLEM TO BE SOLVED: To manufacture a reflector capable of designing a two-dimensional wave motion radiation member which can suppress the interference of radiated wave motion and has specified radiation characteristics, and to provide a reflec tion type liquid crystal display device, its manufacturing method, an optical member, a display device, an illuminator, a display plate and a wave member.

SOLUTION: In the reflector 101 having recesses and projections on its surface, at least a part of the recesses 4 in the surface pattern is disposed according to a specified rule and the same periodic property of the recesses and projections is not obtained in any straight cross sections parallel to each other.



LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

CLAIMS

[Claim(s)]
[Claim 1] The reflecting plate which the toothing crevice of the above or some heights [at least] are arranged according to a predetermined regulation, and is characterized by the shape of above-mentioned toothing in the straight-line-like cross section of arbitration being irregular in the reflecting plate which has the shape of toothing in a field.
[Claim 2] The reflecting plate which the toothing crevice of the above or some heights [at least] are arranged according to a predetermined regulation, and is characterized by the same regularity not appearing mutually this shape of toothing in an parallel straight-line-like cross section mutually [arbitration] in the reflecting plate which has the shape of toothing on a front face.
[Claim 3] The reflecting plate according to claim 1 or 2 characterized by coming to arrange the toothing crevice of the above, or some heights [at least] in the shape of an abbreviation whorl.
[Claim 4] The reflecting plate according to claim 3 characterized by including the crevice or heights which is the multiple whose central angle of the n-th and the n+1st between is 137.5 degrees when a number n is given to a crevice or heights in order of the distance from the core of the above-mentioned whorl.
[Claim 5] The reflecting plate according to claim 3 characterized by including the crevice or heights to which the distance from a spiral core to a crevice or heights is proportional to the square root of n when a number n is given to a crevice or heights in order of the distance from the core of the above-mentioned whorl.
[Claim 6] The reflecting plate according to claim 1 or 2 characterized by coming to arrange the toothing crevice of the above, or some heights [at least] regularly the shape of an approximately concentric circle.
[Claim 7] The reflecting plate according to claim 1 or 2 characterized by coming to arrange the toothing crevice of the above, or some heights [at least] at an abbreviation radial.
[Claim 8] the toothing crevice of the above, or some heights [at least] -- an abbreviation ellipse -- spiral or the reflecting plate according to claim 1 or 2 characterized by coming to be arranged at an abbreviation ellipse radial.
[Claim 9] The reflecting plate according to claim 1 or 2 characterized by being arranged and the toothing crevice of the above or some heights [at least] becoming so that it may have physical relationship [**** / two or more points on the above-mentioned plane coordinates which made n the natural number on the plane coordinates of arbitration, and were obtained in the radius from the zero of the above-mentioned coordinate considering the square root of n, and the phase angle as n times of 137.5 degrees].
[Claim 10] The reflecting plate according to claim 1 or 2 with which 50 percent or more of the thing of all the above-mentioned crevices or the heights is arranged according to the above-mentioned predetermined regulation.
[Claim 11] The reflecting plate according to claim 1 with which it comes to arrange arrangement of the toothing crevice of the above, or heights repeatedly the shape of a matrix.
[Claim 12] The reflecting plate according to claim 1 or 2 characterized by forming toothing the crevice

or heights of the above through processing including the mask exposure and development using a photo mask including the protection-from-light field or light transmission field where at least the part has been arranged according to a predetermined regulation.

[Claim 13] The reflecting plate which the crevice of the shape of toothing of a certain above-mentioned unit field or some heights [at least] are arranged according to a predetermined regulation, and is characterized by the same regularity not appearing mutually this shape of toothing in an parallel straight-line-like cross section mutually [arbitration] similarly [the shape of toothing of all the above-mentioned unit fields] in the reflecting plate with which two or more unit fields which have the shape of toothing were formed in the front face.

[Claim 14] The reflecting plate according to claim 13 characterized by coming to form the above-mentioned unit field in a front face in the shape of a matrix.

[Claim 15] The manufacture approach of the reflecting plate characterized by forming the shape of above-mentioned toothing in the manufacture approach of a reflecting plate of having the shape of toothing on a front face so that arrangement of some the crevices or at least heights may become irregular in the straight-line-like cross section of the arbitration according to a predetermined regulation.

[Claim 16] Processing including the mask exposure and development using a photo mask including the protection-from-light field or light transmission field arranged so that at least the part may follow a predetermined regulation and it may become irregular on the shape of a straight line of the arbitration within the arrangement side is performed. The manufacture approach of the reflecting plate according to claim 15 characterized by this including the process which forms on a substrate the shape of toothing which has a crevice or heights on a front face in the location corresponding to the protection-from-light field or light transmission field of this photo mask, and the process which forms the reflective film on the shape of this toothing.

[Claim 17] The manufacture approach of the reflecting plate characterized by forming the shape of above-mentioned toothing according to a regulation predetermined in arrangement of some the crevices or at least heights in the manufacture approach of a reflecting plate of having the shape of toothing on a front face so that the same regularity may not appear repeatedly in an parallel straight-line-like cross section mutually [the arbitration].

[Claim 18] At least the part follows a predetermined regulation, and processing including the mask exposure and development using a photo mask including the protection-from-light field or light transmission field of the arbitration within the arrangement side arranged so that the same regularity may not appear on an parallel straight line mutually is performed. The manufacture approach of the reflecting plate according to claim 17 characterized by this including the process which forms on a substrate the shape of toothing which has a crevice or heights on a front face in the location corresponding to the protection-from-light field or light transmission field of this photo mask, and the process which forms the reflective film on the shape of this toothing.

[Claim 19] In the liquid crystal display component constituted so that it could become irregular on the electrical potential difference which a liquid crystal layer and this liquid crystal layer are equipped with the reflecting plate arranged at abbreviation parallel, and outdoor daylight is reflected outside with this reflecting plate through this liquid crystal layer, and impresses this liquid crystal layer from the outside The reflective mold liquid crystal display component which the above-mentioned reflecting plate has the shape of toothing on a front face, and the crevice of the shape of this toothing or some heights [at least] are arranged according to a predetermined regulation, and is characterized by the shape of above-mentioned toothing in the straight-line-like cross section of arbitration being irregular.

[Claim 20] In the liquid crystal display component constituted so that it could become irregular on the electrical potential difference which a liquid crystal layer and this liquid crystal layer are equipped with the reflecting plate arranged at abbreviation parallel, and outdoor daylight is reflected outside with this reflecting plate through this liquid crystal layer, and impresses this liquid crystal layer from the outside The reflective mold liquid crystal display component which the above-mentioned reflecting plate has the

shape of toothing on a front face, is arranged according to a regulation predetermined in the crevice of the shape of this toothing, or some heights [at least], and is characterized by being that in which the same regularity does not appear mutually this shape of toothing in an parallel straight-line-like cross section mutually [arbitration].

[Claim 21] The above-mentioned reflecting plate is the reflective mold liquid crystal display component according to claim 19 or 20 which carries out [that the above-mentioned reflective film and the common electrode which were formed in the inside of the above-mentioned opposite substrate come to constitute the electrode for an opposite substrate being arranged so that it may come to form the reflective film which reflects the above-mentioned outdoor daylight on a substrate and may counter through this reflecting plate and the above-mentioned liquid-crystal layer, and modulating the above-mentioned liquid-crystal layer, and] as the description.

[Claim 22] Processing including the mask exposure and development using a photo mask including the protection-from-light field or light transmission field arranged so that at least the part may follow a predetermined regulation and it may become irregular on the shape of a straight line of the arbitration within the arrangement side is performed. The process which forms in a front face on a substrate the shape of toothing which has a crevice or heights in the location corresponding to the protection-from-light field or light transmission field of this photo mask by that cause, The manufacture approach of the reflective mold liquid crystal display component characterized by to include the process which arranges the opposite substrate with which the common electrode was formed in the inside, and the process which encloses liquid crystal between the above-mentioned substrate and this opposite substrate so that the process which forms the reflective film on the shape of this toothing, and the field in which this reflective film of the above-mentioned substrate was formed may be countered.

[Claim 23] At least the part follows a predetermined regulation, and processing including the mask exposure and development using a photo mask including the protection-from-light field or light transmission field of the arbitration within the arrangement side arranged so that the same regularity may not appear on an parallel straight line mutually is performed. The process which forms in a front face on a substrate the shape of toothing which has a crevice or heights in the location corresponding to the protection-from-light field or light transmission field of this photo mask by that cause, The manufacture approach of the reflective mold liquid crystal display component characterized by to include the process which arranges the opposite substrate with which the common electrode was formed in the inside, and the process which encloses liquid crystal between the above-mentioned substrate and this opposite substrate so that the process which forms the reflective film on the shape of this toothing, and the field in which this reflective film of the above-mentioned substrate was formed may be countered.

[Claim 24] It is constituted so that this liquid crystal layer can be modulated on the electrical potential difference impressed from the outside, while having the reflecting plate arranged at abbreviation parallel at the liquid crystal layer and this liquid crystal layer and reflecting outdoor daylight outside with this reflecting plate through this liquid crystal layer. A reflective mold liquid crystal display component with the irregular shape [in / the above-mentioned reflecting plate has the shape of toothing on a front face, and the crevice of the shape of this toothing or some heights / at least / are arranged according to a predetermined regulation, and / the straight-line-like cross section of arbitration] of above-mentioned toothing, The reflective mold liquid crystal display equipped with the driving means which impresses the electrical potential difference for modulating the above-mentioned liquid crystal layer, and drives this reflective mold liquid crystal display component.

[Claim 25] It is constituted so that this liquid crystal layer can be modulated on the electrical potential difference impressed from the outside, while having the reflecting plate arranged at abbreviation parallel at the liquid crystal layer and this liquid crystal layer and reflecting outdoor daylight outside with this reflecting plate through this liquid crystal layer. The above-mentioned reflecting plate has the shape of toothing on a front face, and the crevice of the shape of this toothing or some heights [at least] are

arranged according to a predetermined regulation. And the reflective mold liquid crystal display equipped with the reflective mold liquid crystal display component which is that in which the same regularity does not appear mutually in the shape of [in an parallel straight-line-like cross section / this] toothing, and the driving means which impresses the electrical potential difference for modulating the above-mentioned liquid crystal layer, and drives this reflective mold liquid crystal display component mutually [arbitration].

[Claim 26] The optical member which the optical property to the direction of a station changes in a field, and a part of optical center of action [at least] to which this optical property makes the maximum or the minimum is arranged according to a predetermined regulation in the above-mentioned field, and is characterized by arrangement of the above-mentioned optical center of action on the straight line of the arbitration within the above-mentioned field being irregular.

[Claim 27] The optical member which the optical property to the direction of a station changes in a field, and a part of optical center of action [at least] to which this optical property makes the maximum or the minimum is arranged according to a predetermined regulation in the above-mentioned field, and is characterized by the same regularity not appearing mutually in arrangement of the above-mentioned optical center of action on an parallel straight line mutually [the arbitration within the above-mentioned field].

[Claim 28] The optical member according to claim 26 or 27 characterized by the above-mentioned optical property changing to abbreviation discontinuity between the minute field centering on the above-mentioned optical center of action, and the remaining fields, and coming to have abbreviation constant value in each field.

[Claim 29] The optical member according to claim 26 or 27 characterized by coming to arrange a part of above-mentioned optical center of action [at least] in the shape of an abbreviation whorl.

[Claim 30] The optical member according to claim 29 characterized by including the optical center of action which is the multiple whose central angle of the n-th and the n+1st between is 137.5 degrees when a number n is given to the optical center of action in order of the distance from the core of the above-mentioned whorl.

[Claim 31] The optical member according to claim 29 characterized by including the optical center of action to which the distance from a spiral core to the optical center of action is proportional to the square root of n when a number n is given to the optical center of action in order of the distance from the core of the above-mentioned whorl.

[Claim 32] The optical member according to claim 26 or 27 characterized by coming to arrange a part of above-mentioned optical center of action [at least] regularly the shape of an approximately concentric circle.

[Claim 33] The optical member according to claim 26 or 27 characterized by coming to arrange a part of above-mentioned optical center of action [at least] at an abbreviation radial.

[Claim 34] a part of above-mentioned optical center of action [at least] -- an abbreviation ellipse -- spiral or the optical member according to claim 26 or 27 characterized by coming to be arranged at an abbreviation ellipse radial.

[Claim 35] The optical member according to claim 26 or 27 characterized by being arranged and a part of above-mentioned optical center of action [at least] becoming so that it may have physical relationship [**** / two or more points on the above-mentioned plane coordinates which made n the natural number on the plane coordinates of arbitration, and were obtained in the radius from the zero of the above-mentioned coordinate considering the square root of n, and the phase angle as n times of 137.5 degrees].

[Claim 36] The optical member according to claim 26 or 27 characterized by being arranged and a part of above-mentioned optical center of action [at least] becoming so that it may have physical relationship [**** / the arrangement obtained on the plane coordinates of arbitration by carrying out symmetric transformation of two or more points arranged regularly to concentric circular].

[Claim 37] The optical member according to claim 26 or 27 which comes to arrange arrangement of the above-mentioned optical center of action repeatedly the shape of a matrix.
[Claim 38] The optical member according to claim 26 or 27 characterized by the above-mentioned optical property being a reflection factor.
[Claim 39] The optical member according to claim 26 or 27 characterized by the above-mentioned optical property being a refractive index.
[Claim 40] The optical member according to claim 26 or 27 characterized by the above-mentioned optical property being permeability.
[Claim 41] The optical property to the direction of a station changes for two or more unit fields of every in a field, and the optical property of these all unit fields is the same. And a part of optical center of action [at least] to which this optical property in this a certain unit field makes the maximum or the minimum is arranged according to a predetermined regulation in the field of this unit field. The optical member characterized by the same regularity not appearing mutually in arrangement of the above-mentioned optical center of action on an parallel straight line mutually [the arbitration within the field of this unit field].
[Claim 42] The optical member according to claim 41 characterized by coming to form the above-mentioned unit field in the shape of a matrix in a field.
[Claim 43] It is arranged on the optical path of the light for displaying a display means to display predetermined information, and this information. The optical property to the direction which observes the this information displayed changes in a field. The display characterized by having arranged a part of optical center of action [at least] to which this optical property makes the maximum or the minimum according to a predetermined regulation in the above-mentioned field, and equipping arrangement of the above-mentioned optical center of action on the straight line of the arbitration within the above-mentioned field with an irregular optical member.
[Claim 44] It is arranged on the optical path of the light for displaying a display means to display predetermined information, and this information. The optical property to the direction which observes the this information displayed changes in a field. The display which a part of optical center of action [at least] to which this optical property makes the maximum or the minimum is arranged according to a predetermined regulation in the above-mentioned field, and is characterized by having the optical member to which the same regularity does not appear mutually in arrangement of the above-mentioned optical center of action on an parallel straight line mutually [the arbitration within the above-mentioned field].
[Claim 45] The optical property to the direction which observes the information which is arranged and is this displayed as the luminescence means which emits light on the optical path of the light this **(ed) changes in a field. The lighting system characterized by having arranged a part of optical center of action [at least] to which this optical property makes the maximum or the minimum according to a predetermined regulation in the above-mentioned field, and equipping arrangement of the above-mentioned optical center of action on the straight line of the arbitration within the above-mentioned field with an irregular optical member.
[Claim 46] The optical property to the direction which observes the information which is arranged and is this displayed as the luminescence means which emits light on the optical path of the light this **(ed) changes in a field. The lighting system which a part of optical center of action [at least] to which this optical property makes the maximum or the minimum is arranged according to a predetermined regulation in the above-mentioned field, and is characterized by having the optical member to which the same regularity does not appear mutually in arrangement of the above-mentioned optical center of action on an parallel straight line mutually [the arbitration within the above-mentioned field].
[Claim 47] The optical property to the direction which observes the information which is arranged and is this displayed as the luminescence means which emits light on the optical path of the light this **(ed) changes in a field. A part of optical center of action [at least] to which this optical property makes the

maximum or the minimum is arranged according to a predetermined regulation in the above-mentioned field. The plotting board characterized by having the optical member which it is arranged and arrangement of the above-mentioned optical center of action on the straight line of the arbitration within the above-mentioned field becomes so that the above-mentioned optical center of action may be irregularly distributed in a predetermined display pattern.

[Claim 48] The optical property to the direction which observes the information which is arranged and is this displayed as the luminescence means which emits light on the optical path of the light this **(ed) changes in a field. A part of optical center of action [at least] to which this optical property makes the maximum or the minimum is arranged according to a predetermined regulation in the above-mentioned field. The plotting board characterized by having the optical member which is arranged and becomes so that the same regularity may not appear mutually in arrangement of the above-mentioned optical center of action on an parallel straight line and the above-mentioned optical center of action may be distributed in a predetermined display pattern mutually [the arbitration within the above-mentioned field].

[Claim 49] The wave-motion member which an undulatory radiation property changes in a field, and a part of wave-motion center of action [at least] to which this radiation property makes the maximum or the minimum is arranged according to a predetermined regulation in the above-mentioned field, and is characterized by arrangement of the above-mentioned wave-motion center of action on the straight line of the arbitration within the above-mentioned field being irregular.

[Claim 50] The wave-motion member which an undulatory radiation property changes in a field, and a part of wave-motion center of action [at least] to which this radiation property makes the maximum or the minimum is arranged according to a predetermined regulation in the above-mentioned field, and is characterized by the same regularity not appearing mutually in arrangement of the above-mentioned wave-motion center of action on an parallel straight line mutually [the arbitration within the above-mentioned field].

[Claim 51] The wave-motion member according to claim 49 or 50 characterized by the above-mentioned radiation property changing to abbreviation discontinuity between the minute field centering on the above-mentioned wave-motion center of action, and the remaining fields, and coming to have abbreviation constant value in each field.

[Claim 52] The wave-motion member according to claim 49 or 50 which comes to arrange a part of above-mentioned wave-motion center of action [at least] concentric circular regularly.

[Claim 53] The wave-motion member according to claim 49 or 50 which the above-mentioned wave motion is an acoustic wave, and comes to constitute a sound member by that cause.

[Claim 54] The wave-motion member according to claim 49 or 50 which the above-mentioned wave motion is an electromagnetic wave, and comes to constitute an electromagnetic wave member by that cause.

[Claim 55] The wave-motion member according to claim 49 or 50 which the above-mentioned wave motion is vibration and comes to constitute an oscillating member by that cause.

[Claim 56] The wave-motion member according to claim 49 or 50 which the above-mentioned wave motion is an electric wave, and comes to constitute the Radio Department material by that cause.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to a wave-motion member at the reflecting plate of light and its manufacture approach, a reflective mold liquid crystal display and its manufacture approach, an optical member, a display, a lighting system, the plotting board, and a list.
[0002]
[Description of the Prior Art] The reflective mold display which does not need the light source of a back light etc., for example, a reflective mold liquid crystal display, displays using outdoor daylight, and its power consumption is small and uses it for a portable device in many cases.
[0003] In order to secure brightness sufficient as a reflective mold display, it is possible to use the reflecting plate which consists of metals, such as aluminum with a high reflection factor, and silver. However, specular reflection is produced as the front face of a reflecting plate is flat, the light source is reflected in a reflecting plate, and since any parts other than the part in which the light source of a reflecting plate was reflected hardly reflect light, they are dark, and the display of a display is very hard coming to see them. Then, if much detailed irregularity is formed in the front face of the metallic reflection plate and it is made to scatter light with the irregularity, reflected [the light source] is controlled and a reflection factor can obtain a good reflecting plate. The reflective mold liquid crystal display equipped with such a reflecting plate is indicated by JP,2698218,B, JP,2756206,B, etc.
[0004] By the way, in the reflecting plate which has irregularity on a front face, the direction of the reflected light is dependent on the configuration of the front face. On the other hand, the phenomenon diffracted when light reflects happens in the reflecting plate in which irregularity was formed. Therefore, when irregularity is repeatedly arranged at equal spacing, the light diffracted with the irregularity of the front face of a reflecting plate interferes mutually, and specific wavelength interferes, it suits [a light strong against a specific direction reflects, or] in slight strength, and, thereby, a reflecting plate colors and appears. The example of arrangement of the shape of such toothing is shown in drawing 19 . Moreover, the XX-XX cross section of drawing 19 is shown in drawing 20 . In drawing 19 , the circle expresses the crevice. And the crevice is regularly arranged in the shape of a grid. moreover, drawing 20 -- it is, and although the shape of this toothing is formed in the reflective film 3 formed on the substrate 1 using the concavo-convex layer 2, irregularity is regularly repeated also for that cross-section configuration. In such regular arrangement, interference of the diffracted light takes place and it becomes the display which is hard to see. Then, since interference of the diffracted light is controlled and it whitens the reflected light when arrangement of the shape of toothing within the extension side of a reflecting plate is made irregular, the reflecting plate which has a good reflection property can be obtained.
[0005] Thus, an example of the approach of controlling interference of the diffracted light is indicated by JP,2912176,B. In this example, irregularity is arranged irregularly. Irregularity is suitably arranged so that the distance distribution between adjoining crevices or between heights or concavo-convex height distribution may specifically serve as predetermined dispersion.
[0006]

[Problem(s) to be Solved by the Invention] By making concavo-convex arrangement irregular, it is as having been indicated by the above-mentioned conventional example that interference of the diffracted light is cancelable. However, the concrete design approach about concavo-convex arrangement was not clarified conventionally, but since only irregular extent was clear, the designer of concavo-convex arrangement needed to apply a trial-and-error method so that dispersion might become the predetermined range. Therefore, when carrying out a design change about the display which has a matrix-like pixel (for example, while changing pixel arrangement, when it is newly going to design the reflecting plate which suits it, etc.), concavo-convex arrangement will differ, consequently the tilt angle of a concavo-convex front face was not able to change, and a reflecting plate with a fixed reflection property was not able to be designed.

[0007] Moreover, since this technical problem originates in interference of the diffracted light, if it is the wave motion, it exists in common [without asking exceptions, such as light (light wave), an acoustic wave, an electromagnetic wave, and an oscillatory wave]. Moreover, an undulatory interference is produced, when a wave source is distributed two-dimensional, or when it is dotted with many parts which have the extremal value (maximal value and minimal value) of undulatory intensity of radiation in the wave source of a two-dimensional configuration, and the wave motion which carried out incidence is produced also when it is the wave source which consists of a flat surface which carries out reflection, transparency, refraction, etc. Therefore, the above-mentioned technical problem exists like the reflecting plate of light also in these cases.

[0008] This invention was made in order to solve the above-mentioned technical problem, and it aims at providing the reflecting plate which can design the wave-motion radiation member of the two-dimensional configuration which has the fixed radiation property which can control interference of the wave motion to emit and its manufacture approach, a reflective mold liquid crystal display and its manufacture approach, an optical member, a display, a lighting system, the plotting board, and a list with a wave-motion member.

[0009]

[Means for Solving the Problem] In order to solve the above-mentioned technical problem, the shape [in / the reflecting plate concerning this invention is arranged in the reflecting plate which has the shape of toothing on a front face according to a regulation predetermined in the toothing crevice of the above or some heights / at least /, and / the straight-line-like cross section of arbitration] of above-mentioned toothing is irregular (claim 1).

[0010] Since interference of the diffracted light reflected with the reflecting plate since toothing-like arrangement was irregular when it was this configuration can be canceled and toothing-like arrangement has regularity, a reflection property reproducible at the time of a design can be obtained.

[0011] Moreover, the reflecting plate concerning this invention is arranged in the reflecting plate which has the shape of toothing on a front face according to a regulation predetermined in the toothing crevice of the above, or some heights [at least], and the same regularity does not appear mutually mutually [arbitration] in the shape of [in an parallel straight-line-like cross section / this] toothing (claim 2).

[0012] Since interference of the diffracted light reflected with the reflecting plate since the regularity of toothing-like arrangement was not repeated in the specific direction when it was this configuration can be canceled and toothing-like arrangement has regularity, a reflection property reproducible at the time of a design can be obtained.

[0013] In this case, it is good also as a thing which comes to arrange the toothing crevice of the above, or some heights [at least] in the shape of an abbreviation whorl (claim 3).

[0014] If it is this configuration, the arrangement in which the same regularity does not appear mutually in the shape of [in an parallel straight-line-like cross section] toothing can be offered easily mutually [arbitration].

[0015] In this case, when a number n is given to a crevice or heights in order of the distance from the

core of the above-mentioned whorl, it is good also as a thing containing the crevice or heights which is the multiple whose central angle of the n-th and the n+1st between is 137.5 degrees (claim 4).
[0016] If it is this configuration, distance of an adjoining crevice or heights can be made almost equal, and a reflecting plate with a uniform reflection property can be constituted.
[0017] Moreover, when a number n is given to a crevice or heights in order of the distance from the core of the above-mentioned whorl, it is good also as a thing containing the crevice or heights to which the distance from a spiral core to a crevice or heights is proportional to the square root of n (claim 5).
[0018] Distance of the crevice which adjoins also as this configuration, or heights can be made almost equal, and a reflecting plate with a uniform reflection property can be constituted.
[0019] In the above-mentioned case, also as a thing which comes to arrange the toothing crevice of the above, or some heights [at least] regularly the shape of an approximately concentric circle moreover, often (claim 6) moreover -- as the thing which comes to arrange the toothing crevice of the above, or some heights [at least] at an abbreviation radial -- good (claim 7) -- further -- the toothing crevice of the above, or some heights [at least] -- an abbreviation ellipse -- good (claim 8) also as spiral or a thing which it comes to arrange at an abbreviation ellipse radial.
[0020] If it is this configuration, the interference of the diffracted light based on the regularity of concavo-convex arrangement is cancelable.
[0021] Moreover, it is good also as what it is arranged and the toothing crevice of the above or some heights [at least] become so that it may have physical relationship [**** / two or more points on the above-mentioned plane coordinates which made n the natural number on the plane coordinates of arbitration, and were obtained in the radius from the zero of the above-mentioned coordinate considering the square root of n, and the phase angle as n times of 137.5 degrees] (claim 9).
[0022] If it is this configuration, area which each crevice or heights occupies in a field can be made almost the same, and the distance between an adjoining crevice or heights can realize regular arrangement which gathered almost uniformly.
[0023] Moreover, it is good also as that by which 50 percent or more of the thing of all the above-mentioned crevices or the heights has been arranged according to the above-mentioned predetermined regulation (claim 10).
[0024] If it is this configuration, toothing-like arrangement can be designed easily.
[0025] Moreover, arrangement of the toothing crevice of the above or heights is good also as a thing which it comes to arrange repeatedly the shape of a matrix (claim 11).
[0026] Moreover, it is good though toothing the crevice or heights of the above is formed through processing including the mask exposure and development using a photo mask including the protection-from-light field or light transmission field where at least the part has been arranged according to a predetermined regulation (claim 12).
[0027] If it is this configuration, the reflecting plate which has a good property can be manufactured with easily and sufficient repeatability.
[0028] In the reflecting plate with which two or more unit fields where the reflecting plate concerning this invention has the shape of toothing were formed in the front face Similarly [the shape of toothing of all the above-mentioned unit fields], the crevice of the shape of toothing of a certain above-mentioned unit field or some heights [at least] are arranged according to a predetermined regulation, and the same regularity does not appear mutually mutually [arbitration] in the shape of [in an parallel straight-line-like cross section / this] toothing (claim 13).
[0029] If it is this configuration, when regularity exists in the shape of [in a straight-line-like cross section with a unit field] toothing, it is the arrangement pitch of a unit field and the same regularity will appear, but above constant value, the pitch can cancel the evil according [interference] to interference only, a next door and since it is not recognized practically, when the repeat frequency of the arrangement is small.
[0030] In this case, it is good also as a thing which comes to form the above-mentioned unit field in a

front face in the shape of a matrix (claim 14).
[0031] If it is this configuration, it will become a suitable thing for the reflecting plate of the reflective mold image display device using a pixel.
[0032] Moreover, in the manufacture approach of a reflecting plate of having the shape of toothing on a front face, the manufacture approach of the reflecting plate concerning this invention forms the shape of above-mentioned toothing so that some of the crevices or heights [at least] may become irregular in the straight-line-like cross section of the arbitration according to a predetermined regulation, or so that the same regularity may not appear repeatedly in an parallel straight-line-like cross section mutually [the arbitration] (claims 15 and 17).
[0033] If it is this configuration, the reflecting plate which can cancel interference by diffraction can be manufactured with sufficient repeatability.
[0034] In this case, at least that part follows a predetermined regulation. And processing including the mask exposure and development using the photo mask which includes the protection-from-light field or light transmission field of arbitration arranged so that the same regularity may not appear on an parallel straight line mutually so that it may become irregular in the straight-line-like cross section of the arbitration within the arrangement side is performed. You may make it include the process which forms on a substrate the shape of toothing which has a crevice or heights on a front face in the location corresponding to the protection-from-light field or light transmission field of this photo mask, and the process which forms the reflective film on the shape of this toothing by that cause (claims 16 and 18).
[0035] If it is this configuration, a reflecting plate can be easily manufactured using the photolithography method.
[0036] Moreover, the reflective mold liquid crystal display component concerning this invention equips a liquid crystal layer and this liquid crystal layer with the reflecting plate arranged at abbreviation parallel. In the liquid crystal display component constituted so that it could become irregular on the electrical potential difference which outdoor daylight is reflected outside with this reflecting plate through this liquid crystal layer, and impresses this liquid crystal layer from the outside The above-mentioned reflecting plate has the shape of toothing on a front face, and the crevice of the shape of this toothing or some heights [at least] are arranged according to a predetermined regulation. The same regularity does not appear mutually in the shape of [in an parallel straight-line-like cross section / this] toothing irregularly [this shape of toothing in the straight-line-like cross section of arbitration] mutually [arbitration] (claims 19 and 20).
[0037] If it is this configuration, visibility and the repeatability of the design can offer a good reflective mold liquid crystal display component.
[0038] In this case, it is good in the above-mentioned reflecting plate also as a thing from which the above-mentioned reflective film and the common electrode formed in the inside of the above-mentioned opposite substrate come to constitute the electrode for an opposite substrate being arranged so that it may come to form the reflective film which reflects the above-mentioned outdoor daylight on a substrate and may counter through this reflecting plate and the above-mentioned liquid crystal layer, and modulating the above-mentioned liquid crystal layer (claim 21).
[0039] If it is this configuration, since the reflective film can be used as an electrode, a configuration can be simplified.
[0040] Moreover, the manufacture approach of the reflective mold liquid crystal display component concerning this invention At least the part follows a predetermined regulation. And processing including the mask exposure and development using a photo mask including the protection-from-light field or light transmission field of arbitration arranged so that the same regularity may not appear on an parallel straight line mutually is performed so that the same regularity may not appear on an parallel straight line mutually [the arbitration within the arrangement side]. The process which forms in a front face on a substrate the shape of toothing which has a crevice or heights in the location corresponding to the protection-from-light field or light transmission field of this photo mask by that cause, The process

which arranges the opposite substrate with which the common electrode was formed in the inside, and the process which encloses liquid crystal between the above-mentioned substrate and this opposite substrate are included so that the process which forms the reflective film on the shape of this toothing, and the field in which this reflective film of the above-mentioned substrate was formed may be countered (claims 22 and 23).

[0041] If it is this configuration, visibility and the repeatability of the design can manufacture easily a good reflective mold liquid crystal display component by the photolithography method.

[0042] Moreover, the reflective mold liquid crystal display concerning this invention has the reflecting plate arranged at abbreviation parallel at the liquid crystal layer and this liquid crystal layer. It is constituted so that this liquid crystal layer can be modulated on the electrical potential difference impressed from the outside, while outdoor daylight is reflected outside with this reflecting plate through this liquid crystal layer. The above-mentioned reflecting plate has the shape of toothing on a front face, and the crevice of the shape of this toothing or some heights [at least] are arranged according to a predetermined regulation. And the reflective mold liquid crystal display component this whose shape of toothing in the straight-line-like cross section of arbitration is that in which the same regularity does not appear mutually irregularly mutually [arbitration] in the shape of [in an parallel straight-line-like cross section / this] toothing, It has the driving means which impresses the electrical potential difference for modulating the above-mentioned liquid crystal layer, and drives this reflective mold liquid crystal display component (claims 24 and 25).

[0043] If it is this configuration, visibility and the repeatability of the design can offer a good reflective mold liquid crystal display.

[0044] Moreover, arrangement of the optical above-mentioned [an optical property / as opposed to the direction of a station in the optical member concerning this invention / changes in a field, is arranged according to the regulation predetermined / in the above-mentioned field / in a part of optical center of action / at least / to which this optical property makes the maximum or the minimum, and] center of action on the straight line of the arbitration within the above-mentioned field is irregular (claim 26).

[0045] Since interference of the diffracted light which received the optical operation since arrangement of the optical center of action was irregular when it was this configuration can be canceled and arrangement of the optical center of action has regularity, an optical property reproducible at the time of a design can be obtained.

[0046] Moreover, an optical property [as opposed to the direction of a station in the optical member concerning this invention] changes in a field, and is arranged according to the regulation predetermined [in the above-mentioned field] in a part of optical center of action [at least] to which this optical property makes the maximum or the minimum, and the same regularity does not appear mutually mutually [the arbitration within the above-mentioned field] in arrangement of the above-mentioned optical center of action on an parallel straight line (claim 27).

[0047] Since interference of the diffracted light which received the optical operation since the regularity of arrangement of the optical center of action was not repeated in the specific direction when it was this configuration can be canceled and arrangement of the optical center of action has regularity, an optical property reproducible at the time of a design can be obtained.

[0048] Moreover, it is good also as a thing which the above-mentioned optical property changes to abbreviation discontinuity between the minute field centering on the above-mentioned optical center of action, and the remaining fields, and comes to have abbreviation constant value in each field (claim 28).

[0049] Moreover, it is good also as a thing which comes to arrange a part of above-mentioned optical center of action [at least] in the shape of an abbreviation whorl (claim 29).

[0050] If it is this configuration, the optical center of action in an parallel straight-line-like cross section can be easily provided with the arrangement in which the same regularity does not appear mutually mutually [arbitration].

[0051] In this case, when a number n is given to the optical center of action in order of the distance

from the core of the above-mentioned whorl, When a number n is given to the optical center of action in order of the distance from the core of the above-mentioned whorl well (claim 30) also as a thing containing the optical center of action which is the multiple whose central angle of the n-th and the n+1st between is 137.5 degrees, It is good also as a thing containing the optical center of action to which the distance from a spiral core to the optical center of action is proportional to the square root of n (claim 31).

[0052] If it is this configuration, distance of the adjoining optical centers of action can be made almost equal, and an optical member with a uniform optical property can be constituted.

[0053] In the above-mentioned case, also as a thing which comes to arrange a part of above-mentioned optical center of action [at least] regularly the shape of an approximately concentric circle moreover, often (claim 32) moreover -- as the thing which comes to arrange a part of above-mentioned optical center of action [at least] at an abbreviation radial -- good (claim 33) -- further -- a part of above-mentioned optical center of action [at least] -- an abbreviation ellipse -- good (claim 34) also as spiral or a thing which it comes to arrange at an abbreviation ellipse radial.

[0054] If it is this configuration, the interference of the diffracted light based on the regularity of arrangement of the optical center of action is cancelable.

[0055] Moreover, it is also as what it is arranged and a part of above-mentioned optical center of action [at least] becomes so that it may have physical relationship [**** / two or more points on the above-mentioned plane coordinates which made n the natural number on the plane coordinates of arbitration, and were obtained in the radius from the zero of the above-mentioned coordinate considering the square root of n, and the phase angle as n times of 137.5 degrees] (claim 35).

[0056] If it is this configuration, area which each optical center of action occupies in a field can be made almost the same, and the distance between the adjoining optical centers of action can realize regular arrangement which gathered almost uniformly.

[0057] Moreover, it is good also as what it is arranged and a part of above-mentioned optical center of action [at least] becomes so that it may have physical relationship [**** / the arrangement obtained on the plane coordinates of arbitration by carrying out symmetric transformation of two or more points arranged regularly to concentric circular] (claim 36).

[0058] Moreover, arrangement of the above-mentioned optical center of action is good also as a thing which it comes to arrange repeatedly the shape of a matrix (claim 37).

[0059] Moreover, it is good though the above-mentioned optical property is a reflection factor (claim 38).

[0060] If it is this configuration, interference of the diffracted light can be canceled and the design repeatability of a reflection property can offer a good reflective member.

[0061] Moreover, it is good though the above-mentioned optical property is a refractive index (claim 39).

[0062] If it is this configuration, interference of the diffracted light can be canceled and the design repeatability of a refraction property can offer a good refraction member.

[0063] Moreover, it is good though the above-mentioned optical property is permeability (claim 40).

[0064] If it is this configuration, interference of the diffracted light can be canceled and the design repeatability of a transparency property can offer good translucent part material.

[0065] Moreover, the optical member concerning this invention changes for every unit field of the plurality [optical property / to the direction of a station] in a field. The optical property of these all unit fields is the same, and a part of optical center of action [at least] to which this optical property in this a certain unit field makes the maximum or the minimum is arranged according to a predetermined regulation in the field of this unit field. The same regularity does not appear mutually mutually [the arbitration within the field of this unit field] in arrangement of the above-mentioned optical center of action on an parallel straight line (claim 41).

[0066] If it is this configuration, when regularity exists in the optical center of action on a certain straight line within the field of a unit field, it is the arrangement pitch of a unit field and the same regularity will appear, but above constant value, the pitch can cancel the evil according [interference]

to interference only, a next door and since it is not recognized practically, when the repeat frequency of the arrangement is small.

[0067] In this case, it is good also as a thing which comes to form the above-mentioned unit field in the shape of a matrix in a field (claim 42).

[0068] Moreover, a display means by which the display concerning this invention displays predetermined information, The optical property to the direction which observes the information which is arranged and is this displayed on the optical path of the light for displaying this information changes in a field. A part of optical center of action [at least] to which this optical property makes the maximum or the minimum is arranged according to a predetermined regulation in the above-mentioned field. Arrangement of the above-mentioned optical center of action on the straight line of the arbitration within the above-mentioned field equips arrangement of the above-mentioned optical center of action on an parallel straight line with the optical member of each other [irregularly or / arbitration] in which the same regularity does not appear mutually (claims 43 and 44).

[0069] If it is this configuration, visibility and its design repeatability can offer a good display.

[0070] Moreover, the lighting system concerning this invention is arranged on the luminescence means which emits light, and the optical path of the light this **(ed). The optical property to the direction which observes the this information displayed changes in a field. A part of optical center of action [at least] to which this optical property makes the maximum or the minimum is arranged according to a predetermined regulation in the above-mentioned field. Arrangement of the above-mentioned optical center of action on the straight line of the arbitration within the above-mentioned field equips arrangement of the above-mentioned optical center of action on an parallel straight line with the optical member of each other [irregularly or / arbitration] in which the same regularity does not appear mutually (claims 45 and 46).

[0071] If it is this configuration, visibility and its design repeatability can offer a good lighting system.

[0072] Moreover, the plotting board concerning this invention is arranged on the luminescence means which emits light, and the optical path of the light this **(ed). The optical property to the direction which observes the this information displayed changes in a field. A part of optical center of action [at least] to which this optical property makes the maximum or the minimum is arranged according to a predetermined regulation in the above-mentioned field. The same regularity does not appear mutually in arrangement of the above-mentioned optical center of action on an parallel straight line irregularly [arrangement of the above-mentioned optical center of action on the straight line of the arbitration within the above-mentioned field] mutually [arbitration]. And it has the optical member which is arranged and becomes so that the above-mentioned optical center of action may be distributed in a predetermined display pattern (claims 47 and 48).

[0073] If it is this configuration, visibility and its design repeatability can offer the good plotting board.

[0074] Moreover, the wave-motion member concerning this invention has irregular arrangement of the wave-motion center of action a part of wave-motion center of action [at least] to which an undulatory radiation property changes in a field, and this radiation property makes the maximum or the minimum is arranged according to a predetermined regulation in the above-mentioned field, and above-mentioned [on the straight line of the arbitration within the above-mentioned field] (claim 49).

[0075] If it is this configuration, while interference by the diffraction of the wave motion to emit is cancelable, the design repeatability of the radiation property of the wave motion can offer a good wave-motion member.

[0076] Moreover, as for the wave-motion member concerning this invention, a part of wave-motion center of action [at least] to which an undulatory radiation property changes in a field, and this radiation property makes the maximum or the minimum is arranged according to a predetermined regulation in the above-mentioned field, and the same regularity does not appear mutually mutually [the arbitration within the above-mentioned field] in arrangement of the above-mentioned wave-motion center of action on an parallel straight line (claim 50).

[0077] While interference by the diffraction of the wave motion emitted also as this configuration is cancelable, the design repeatability of the radiation property of the wave motion can offer a good wave-motion member.
[0078] Moreover, it is also as a thing which the above-mentioned radiation property changes to abbreviation discontinuity between the minute field centering on the above-mentioned wave-motion center of action, and the remaining fields, and comes to have abbreviation constant value in each field (claim 51).
[0079] Moreover, a part of above-mentioned wave-motion center of action [at least] is good for concentric circular also as a thing which it comes to arrange regularly (claim 52).
[0080] If it is this configuration, interference of the wave motion by the regularity of arrangement of the wave-motion center of action is cancelable.
[0081] Moreover, it is good also as a thing which the above-mentioned wave motion is an acoustic wave, and comes to constitute a sound member by that cause (claim 53).
[0082] If it is this configuration, the radiation property and its design repeatability of a sound can offer a good sound member.
[0083] Moreover, it is good also as a thing which the above-mentioned wave motion is an electromagnetic wave, and comes to constitute an electromagnetic wave member by that cause (claim 54).
[0084] If it is this configuration, the radiation property and its design repeatability of an electromagnetic wave can offer a good electromagnetic wave member.
[0085] Moreover, it is good also as a thing which the above-mentioned wave motion is vibration and comes to constitute an oscillating member by that cause (claim 55).
[0086] If it is this configuration, the radiation property and its design repeatability of vibration can offer a good oscillating member.
[0087] Moreover, it is good also as a thing which the above-mentioned wave motion is an electric wave, and comes to constitute the Radio Department material by that cause (claim 56).
[0088] It starts, and if constituted, the radiation property and its design repeatability of an electric wave can offer the good Radio Department material.
[0089]
[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained, referring to a drawing.
The top view and drawing 2 which show the configuration of the reflecting plate which gestalt 1 [reflecting plate] drawing 1 of operation requires for the gestalt 1 of operation of this invention show the II-II sectional view of drawing 1 .
[0090] As shown in drawing 2 , the concavo-convex layer 2 is formed on the flat substrate 1, the reflective film 3 is formed on this concavo-convex layer 2, and the reflecting plate 101 is constituted. The reflective film 3 is what has the shape of toothing which followed in the shape of [of the front face of the concavo-convex layer 2] toothing by this, and the front face of the reflective film 3 constitutes the front face of a reflecting plate 101.
[0091] The concavo-convex layer 2 consists of photopolymers, and after removing the part which should form a crevice by the photolithography method, the shape of smooth toothing is formed in the front face by carrying out melt flow of this photopolymer. The reflective film 3 consists of metal membranes with a high reflection factor, and consists of aluminum film with a thickness of 0.2 micrometers here. In addition, the reflective film 3 may consist of metals with the high reflection factor of silver besides aluminum etc.
[0092] The crevice 4 is shown to drawing 1 by the circle among the shape of toothing of the reflective film 3. As shown in drawing 1 , the crevice 4 is arranged on the locus of the shape of an abbreviation whorl centering on the predetermined point C on the principal plane of a substrate 1. This arrangement is explained in full detail later. Therefore, in the reflecting plate 101, the crevice 4 of the front face is

arranged according to the predetermined regulation, and as shown in drawing 2 , as for the shape [in / on the other hand / the straight-line-like cross section of arbitration] of the surface type, it has the shape of irregular toothing.

[0093] In the reflecting plate 101 constituted as mentioned above, if outdoor daylight carries out incidence, it will be reflected on the front face of the reflective film 3. Since the shape of surface type in the straight-line-like cross section of the arbitration of the reflective film 3 is irregular in that case, interference by the diffraction of the reflected light is canceled, it whitens this reflected light, and a good reflection property is obtained. Moreover, since a crevice 4 can be arranged according to the regulation also in case a design change etc. is carried out, since the crevice 4 of the reflective film 3 is arranged according to the fixed regulation, it is possible to design the reflecting plate 101 which has a fixed reflection property. This effectiveness is explained in detail later.

The top view and drawing 4 which show the configuration of the reflective mold liquid crystal display component which [liquid crystal display component] drawing 3 requires for the gestalt of this operation are the IV-IV sectional view of drawing 3 . In drawing 3 , the liquid crystal display component is drawn in fluoroscopy.

[0094] As shown in drawing 3 and drawing 4 , liquid crystal 14 is pinched between reflecting plate 101' and the opposite substrates (color filter substrate) 103 which have been arranged so that it may counter at the predetermined spacing, the phase contrast plate 12 and a deflecting plate 13 are arranged at this order, and the reflective mold liquid crystal display component (only henceforth a liquid crystal display component) 102 is constituted by the external surface of the opposite substrate 103.

[0095] Reflecting plate 101' is a reflecting plate concerning the gestalt of this above-mentioned operation. However, the concavo-convex layer 2 and reflective film (henceforth pixel reflective film) 3' are formed on the substrate 1 with which the source line SL, the gate line GL, and the switching element 6 connected to these were formed, and this source line SL, the gate line GL, and the switching element 6 were formed on the substrate 1 which consists of alkali free glass, for example, and reflecting plate 101' is constituted here. The source line SL and the gate line GL are formed in the shape of a matrix on a substrate 1, and the field divided by the source line SL and gate line GL constitutes the pixel 201. And the switching element 6 is formed every pixel 201. The switching element 6 consists of TFT(s) (Thin Film Transistor) here. Pixel reflective film 3' is connected to terminal 6a of a switching element 6 through the contact hole 7 which was divided and formed every pixel 201, and was formed so that the concavo-convex layer 2 might be penetrated. That is, pixel reflective film 3' is arranged every pixel 201, and it constitutes the pixel electrode while it constitutes the metallic reflective layer of reflecting plate 101'. Moreover, pixel reflective film 3' is arranged in the shape of the crevice's 4 centering on predetermined point C abbreviation-whole pixel 201 whorl so that clearly from drawing 3 .

[0096] As for the opposite substrate 103, the common electrode 9 which becomes the inside of the substrate 11 which consists of alkali free glass from a color filter 10 and a transparent electrode is formed in this order. In addition, Signs 10a, 10b, and 10c show the field of each primary color of R (red), G (green), and B (blue), respectively.

[0097] Next, actuation of the liquid crystal display component 102 constituted as mentioned above is explained. With this liquid crystal display component 102, incidence is carried out from a polarizing plate 13 side, sequential passage of this polarizing plate 13, the phase contrast plate 12, a substrate 11, a color filter 10, the common electrode 9, and the liquid crystal 14 is carried out, and outdoor daylight reflects on the front face of pixel reflective film 3', passes the above-mentioned each part material in reverse order, and carries out outgoing radiation outside from a polarizing plate 13. On the other hand, sequential ON of the switching element 6 of each pixel 201 is carried out by the gate signal inputted into the gate line GL, timing is doubled with this and the sequential input of the video signal is carried out from the source line SL at pixel reflective film 3' of each pixel 201. Thereby, the electrical potential difference according to the video signal is impressed between pixel reflective film 3' and the common electrode 9, and the reflection factor of the outdoor daylight in each pixel 201 changes according to the

electrical potential difference. Thereby, the image corresponding to the above-mentioned video signal is reflected in the eyes of those who observe the liquid crystal display component 102. Under the present circumstances, good visibility can be acquired when outdoor daylight is scattered about by pixel reflective film 3'.

the shape of an abbreviation whorl to which the reflecting plate 101 of [design approach of reflecting plate] drawing 1 and the crevice 4 of reflecting plate 101' of drawing 3 set the predetermined point C as a spiral core as mentioned above based on a predetermined regulation -- and it is regularly arranged in order in the direction which separates from the core, and has become approximately concentric circle-like arrangement. Drawing 5 shows arrangement according to this regulation. The location of many points 301 is expressed by plane coordinates (polar coordinate) in drawing 5 . And when making n into the natural number, the radius r from there is proportional to the square root of n centering on the zero of the plane coordinates, and each point 301 is located so that the phase angle theta may become n times which is 137.5 degrees. The number is shown in drawing 5 to n= 6. When the 1st point makes A a proportionality constant, more specifically, r=Axroot1=A (micrometer) and theta = the 137.5 (degree) or 2nd point are located so that r=Axroot2 (micrometer), theta= 2x137.5 (degree), and the n-th point may be set to r=Axrootn (micrometer) and theta=n x137.5 (degree). This arrangement shown in drawing 5 is arrangement looked at by natures, such as a seed of a sunflower.

[0098] It is mathematically led from the theory called fibonacci series, and the include angle of 137.5 degrees can be made the regular arrangement which gathered almost equally by spacing with the adjoining point 301 at the time of this include angle. Moreover, when the point 301 has been arranged in order toward the circumference from the core by arranging the distance from a core so that it may be proportional to the square root of n, it is possible to make spacing with the point 301 that each point 301 can make almost the same area occupied on the above-mentioned plane coordinates, and adjoins the arrangement which gathered almost equally.

[0099] Concavo-convex arrangement of pixel reflective film 3' of the liquid crystal display component 102 of drawing 3 is the same concavo-convex arrangement as the inside of the field 202 shown in drawing 1 , takes out two or more points arranged by the approach shown in drawing 5 , and is obtained by applying arrangement [**** / this] to the field of a pixel 201. Since it is such, the central angle between the n-th thing and the n+1st things is the multiple which is 137.5 degrees, and the reflecting plate 101 of drawing 1 and concavo-convex arrangement of reflecting plate 101of drawing 3 ' are arrangement which consists of crevices 4 where the distance from a spiral core is proportional to the square root of n, when a number n is given to a crevice 4 in order of the distance from the spiral core C.

[0100] When irregularity had been regularly arranged by this approach, as shown in drawing 2 and drawing 4 , in the cross section of the shape of a straight line of the arbitration of reflecting plate 101,101', this artificer discovered that the shape of irregular surface type with which the same irregularity was not repeatedly located in a line with, but various configurations were combined could be formed. Thus, the reflected light diffracted with irregularity interferes in the reflecting plate 101 and the liquid crystal display component 102 which have the shape of surface type with the irregular cross section of the shape of a straight line of arbitration, and they do not suit in slight strength, therefore can cancel interference.

[0101] In addition, when the above-mentioned proportionality constant A is A= 1 (micrometer), spacing of adjoining crevices is set to about 1.9 (micrometer). By changing the value of a proportionality constant A to arbitration, it becomes possible to design spacing of adjoining crevices to arbitration. As mentioned above, simple count can determine concavo-convex arrangement.

[0102] In addition, in case concavo-convex arrangement is arranged in a pixel 201 as mentioned above, near the boundary of the field in a pixel 201, and the boundary region of a pixel 201, a crevice may straddle a boundary. When a crevice straddled the boundary of a pixel 201, it was made not to form a crevice in principle in the example of the liquid crystal display component 102 of drawing 3 R> 3. In addition, it does not do in this way but you may make it form a crevice ranging over a boundary.

[0103] Moreover, a crevice 4 does not need to be arranged at the point that all followed the above-mentioned regulation, and, in addition to arrangement of the crevice 4 according to the above-mentioned regulation, may arrange a crevice 4 at the point of the arbitration according to the regulation. Drawing 14 adds crevice 4a according to the above-mentioned regulation to the part where a crevice 4 becomes a non-dense near point C based on arrangement of drawing 1 . Thus, crevice 4a other than arrangement of the crevice 4 according to a regulation can be added, and the crevice 4 arranged regularly and crevice 4a arranged at arbitration can also be made intermingled. The direction with many rates of the crevice 4 regularly arranged compared with crevice 4a arranged at arbitration also at this time is desirable, and it is desirable to design arrangement of a crevice so that at least 50 percent of all crevices may follow regular arrangement.

[0104] Moreover, based on regular arrangement, by thinning out a crevice, the number of crevices may be reduced and arrangement of a crevice may be designed. Drawing 15 removes some crevices based on arrangement of drawing 1 . Even when the number of crevices is reduced, the design of the reflecting plate which controlled interference similarly is possible.

[0105] Moreover, although only the arrangement (henceforth regulation arrangement) according to one regulation has been arranged to one pixel reflective film 3' with the above-mentioned liquid crystal display component 102, one pixel reflective film 3' may be formed combining two or more regulation arrangement. Drawing 16 shows arrangement of the crevice of the field equivalent to pixel reflective film 3' of drawing 3 , and combines arrangement which is different by right and left of pixel reflective film 3'. The same effectiveness as the above can be acquired also by this.

[0106] Moreover, the arrangement which does not necessarily need to be in the field which arranges irregularity and does not have the spiral core C like drawing 17 all over the field (the field which is equivalent to pixel reflective film 3' by a diagram is shown) where a crevice 4 is arranged is sufficient as a spiral core.

[0107] Moreover, in the above-mentioned example, although concavo-convex arrangement was applied to one pixel reflective film 3', ranging over two or more pixel reflective film 3', the arrangement based on one regulation may be applied like drawing 18 . For example, it is good also as spiral arrangement which has one core for concavo-convex arrangement about all pixel reflective film 3' of a liquid crystal display component.

[0108] Moreover, although the configuration of a crevice showed the case where it was a circle, in the above-mentioned example, the square of the arbitration containing the triangle of the arbitration containing the polygon of arbitration, i.e., an equilateral triangle, and an isosceles triangle, a rectangle, a square, and a trapezoid is sufficient as it, and the pentagon of arbitration, a hexagon, and the polygon that has an angle beyond it are sufficient as it similarly.

[0109] Moreover, as for the tilt angle of the front face of the shape of toothing over the extension side of a reflecting plate, it is desirable to be mostly distributed at five - about 10 degrees. Moreover, as for the number of a crevice or heights, considering as ten or more pieces is desirable. Moreover, as for the number of a crevice or heights, it is desirable to consider as about 10-300 pieces, and, as for the path of a crevice or heights, it is desirable to be referred to as 5 micrometers - 50 micrometers.

[Manufacture approach of reflecting plate and liquid crystal display component] drawing 6 is drawing showing the manufacture approach of the reflecting plate concerning the gestalt of this operation, and (a) - (d) is the sectional view according to process showing each process.

[0110] In order to manufacture a reflecting plate, as shown in drawing 6 (a), photosensitive ingredient 2' which consists of a positive type photosensitivity ingredient by the thickness of 2.0 micrometers is first applied on a substrate 1. Then, mask exposure is carried out with the photo mask 15 with which light transmission field 15a was formed in the part which should form a crevice, and protection-from-light field 15b was formed in the other part, respectively, and, thereby, the part corresponding to the above-mentioned light transmission field 15a of photosensitive ingredient 2' is exposed.

[0111] Subsequently, negatives are developed to this substrate 1 by which mask exposure was carried

out, and this forms opening 16 in the above-mentioned sensitization part of photosensitive ingredient 2', as shown in drawing 6 (b).

[0112] Subsequently, the substrate 1 with which this opening 16 was formed is heat-treated with the glass transition temperature of photosensitive ingredient 2' before hardening, and this forms the concavo-convex layer 2 which has irregularity for photosensitive ingredient 2' on a front face as plugged up the above-mentioned opening 16 while carrying out melt flow and rounding off a front face, and shown in drawing 6 R> 6 (c). Here, melt flow points out the property or the phenomenon which the angle of a membranous front face causes form status change-ization -- the round-head relaxation film flows a substrate top -- when the film becomes soft with heating.

[0113] Subsequently, the substrate 1 with which this concavo-convex layer 2 was formed is calcinated with the curing temperature of a photosensitive ingredient, and this concavo-convex layer 2 is stiffened.

[0114] Subsequently, the reflective film 3 which consists of a metal of a high reflection factor on the concavo-convex layer 2 is made into predetermined thickness at formation. Thereby, a reflecting plate 101 is obtained.

[0115] Next, the manufacture approach of the liquid crystal display component concerning the gestalt of this operation is explained using drawing 4 . In order to manufacture the liquid crystal display component 102, the source line SL, the gate line GL, and a switching element 6 are first formed on a glass substrate 1 by the well-known photolithography method, respectively. Subsequently, the concavo-convex layer 2 is formed like the above on this source line SL, the gate line GL, and the substrate 1 with which the switching element 6 was formed. Then, while forming reflective film 3' divided every pixel 201 by forming the metal membrane of a high reflection factor on the concavo-convex layer 2, using a photoresist for a mask and etching the metal membrane, a contact hole 7 is formed in the part which remained without closing the above-mentioned opening of the concavo-convex layer 2. Thereby, reflecting plate 101' is obtained.

[0116] On the other hand, by the well-known photolithography method, sequential formation of a color filter 10 and the common electrode 9 is carried out on a glass substrate 11, and the opposite substrate 103 is obtained.

[0117] Subsequently, as it has a predetermined gap for reflecting plate 101' and the opposite substrate 103, liquid crystal 14 is poured in and closed in lamination and its gap. Subsequently, the phase contrast plate 12 and a deflecting plate 13 are stuck on the outside of the opposite substrate 103 one by one. Thereby, the liquid crystal display component 102 is obtained.

[0118] According to the above reflecting plate 101 and the manufacture approach of the liquid crystal display component 102, the irregularity of the front face of reflecting plate 101,101' can be easily formed by the photolithography method using melt flow.

[0119] In addition, according to above-mentioned concavo-convex arrangement, the photo mask 15 used here forms light transmission field 15a of a predetermined path in the part equivalent to a crevice, and sets the other part to protection-from-light field 15b. Thereby, the crevice 4 was able to be formed in the location [**** / the light transmission field of the above-mentioned photo mask 15] on the front face of reflecting plate 101,101'. In addition, when a negative-mold photosensitivity ingredient is used as an ingredient which forms the concavo-convex layer 2, the photo mask of a configuration of having reversed the above-mentioned light transmission field and the protection-from-light field is used.

[0120] Thus, according to the photolithography method, since concavo-convex arrangement is decided depending on the mask pattern of the photo mask 15 in the case of exposure, the design of a photo mask 15 serves as most important element that determines the reflection property of reflecting plate 101,101'. With the gestalt of this operation, this arrangement became possible [not changing on the occasion of the design change of a photo mask, and designing the reflecting plate of a predetermined reflection property easily] by designing regularly the photo mask 15 which influences the reflection property of reflecting plate 101,101' as mentioned above.

The gestalt 2 of operation of gestalt 2 this invention of operation shows the example which changed the

arrangement include angle of the crevice in abbreviation spiral arrangement. That is, with the gestalt 1 of operation, although the crevice 4 has been arranged for every include angle of 137.5 degrees, it can set up instead of the include angle of 137.5 degrees at other include angles, and concavo-convex arrangement can also be designed. The example at the time of making this include angle into 142 degrees is shown in drawing 7 . Moreover, the VIII-VIII cross section of drawing 7 is shown in drawing 8 . In this case, the crevice 4 of a reflecting plate 101 serves as abbreviation whorl-like arrangement, as shown in drawing 7 , and as the shape of surface type in the straight-line-like cross section of arbitration is shown in drawing 8 , irregularity with a different configuration stands in a row. For this reason, interference of the reflected light does not occur and the same effectiveness as the gestalt 1 of operation can be acquired.

The gestalt 3 of operation of gestalt 3 this invention of operation shows other examples which changed the include angle of arrangement of the crevice in abbreviation spiral arrangement. Although the crevice 4 has been arranged for every include angle of 137.5 degrees with the gestalt 1 of operation, what has arranged the crevice 4 every 15 degrees instead of 137.5 degrees is shown in drawing 9 . In this case, the arrangement with which the crevice 4 was located in a line with the abbreviation radial is obtained. The X-X cross section of drawing 9 is shown in drawing 10 . Moreover, similarly a XI-XI cross section is shown in drawing 11 . Also in this concavo-convex arrangement, interference of the reflected light was able to be controlled like the gestalt 1 of operation. In the case of the gestalt of this operation, it differed in the gestalten 1 and 2 of operation, if only the X-X cross section shown in drawing 10 is seen, the concavo-convex pitch will have gathered comparatively (repeated with a certain regularity), and possibility that interference of the reflected light will occur can be considered. However, in the XI-XI cross section parallel to a X-X cross section shown in drawing 11 , it is the cross section of a different configuration from a X-X cross section. In such a case, if a specific cross section is seen, although the same irregularity has gathered with regularity, as the reflecting plate 101 whole, it is not recognized by human being's eyes as interference. This is based on the following reasons.

[0121] That is, the interference of the diffracted light based on regular irregularity is observed in the shape of a field, when a reflecting plate 101 is seen. For this reason, in order for that interference to be recognized by human being who looks at a reflecting plate 101, two conditions, that the cross-section configuration of the irregularity in a 1 straight-line-like cross section is regular and appearing [in a cross section parallel to the 2 above-mentioned cross section / the same regularity]-repeatedly **, are required. The above 2 is not filled with the gestalt of this operation so that concavo-convex cross-section configurations may differ in the XI-XI cross section shown in the X-X cross section shown in drawing 10 , and drawing 11 . That is, in a reflecting plate without the concavo-convex arrangement which repeats the same regularity as the one direction within a reflector, interference cannot be recognized but the interference based on concavo-convex arrangement can be canceled. Moreover, in the arrangement which comes to repeat such concavo-convex arrangement to an one direction, although the same regularity will appear in the pitch of the repeat, when the frequency of the repeat is small, it becomes small interfering the pitch and it is not practically recognized above constant value. The pitch which is not recognized as this interference is 50 micrometers or more in experience of this artificer. And in the image display device made highly minute, since the arrangement pitch of a pixel is 50 micrometers, such concavo-convex arrangement is also applicable to the reflecting plate of an image display device enough.

The gestalt 4 of operation of gestalt 4 this invention of operation shows the example which transformed arrangement of an above-mentioned crevice so that the irregularity might not be lost. Although the gestalten 1-3 of operation showed the example by which the crevice has been arranged at the abbreviation swirl or the abbreviation radial, the same effectiveness can be acquired also in the configuration which has arranged the crevice to the abbreviation ellipse swirl which is contracted or expanded and becomes specific shaft orientations about these arrangement, or the abbreviation ellipse radial. Abbreviation ellipse whorl-like arrangement is shown in drawing 12 , and arrangement of an

abbreviation ellipse radial is shown in drawing 13 .
[0122] In addition, the same effectiveness can be acquired, even when not only a crevice but heights are arranged by the same approach and a reflecting plate and a reflective mold liquid crystal display component are altogether constituted from gestalten 1-4 of the above-mentioned implementation, although arrangement of the crevice of toothing-like inside was shown.
[0123] Moreover, with the gestalten 1-4 of the above-mentioned implementation, although arrangement of an abbreviation swirl, an abbreviation radial, an abbreviation ellipse swirl, and an abbreviation ellipse radial was shown, also except these arrangement, the shape of surface type in the cross section of the straight line of the arbitration of a reflecting plate can cancel interference, and can acquire the same effectiveness as the gestalten 1-4 of operation with an irregular reflecting plate. Moreover, if a specific cross section is seen, even if the same irregularity has gathered with regularity, in the reflecting plate which does not fulfill two conditions, that the cross-section configuration of the irregularity in a 1 straight-line-like cross section is regular, and appearing [in a cross section parallel to the 2 above-mentioned cross section / the same regularity]-repeatedly **, interference can be canceled and the same effectiveness as the gestalten 1-4 of operation can be acquired.
[0124] Furthermore, although the gestalten 1-4 of the above-mentioned implementation showed arrangement of the abbreviation swirl on the basis of the arrangement (henceforth basic arrangement) which arranges a crevice or heights based on the distance from the core of the whorl of the gestalt 1 of operation, concentric circular, and a radial, even if arrangement of an abbreviation swirl, concentric circular, and a radial is not due to this basic arrangement, practical use can usually be presented with it. When arranged regularly radial, on a straight line parallel to it, arrangement of an abbreviation swirl, concentric circular, and a radial does not turn into regular arrangement, and does not fulfill the conditions of the above 1 and interference of two. Moreover, although the arrangement on parallel 2 straight lines which face across that central point in the center becomes the same when arranged centering on the central point of those arrangement at the symmetry, it is because those spacing is separated even if that arrangement generally does not become regular even in this case and it becomes regular, so it is hard to produce interference.
Gestalt 5 drawing 21 of operation is the block diagram showing the configuration of the reflective mold liquid crystal display concerning the gestalt 5 of operation of this invention. As shown in drawing 21 , the reflective mold liquid crystal display 400 concerning the gestalt of this operation drives the source line SL and the gate line GL of the liquid crystal display component 102 of operation by the source drive circuit 402 and the gate drive circuit 403, respectively, and it constitutes them so that the source drive circuit 402 and the gate drive circuit 403 may be controlled by the digital disposal circuit 401. [of a gestalt 1] If it is such a configuration, the permeability of the outdoor daylight in which the liquid crystal display component 102 drives by the gate drive circuit 403 and the source drive circuit 402, carries out incidence to the pixel reflective film, and is reflected there will be changed. Thereby, the image corresponding to the video signal of the source line GL is reflected in the eyes of those who observe a liquid crystal display 400. In that case, when outdoor daylight is scattered about by the pixel reflective film, good visibility can be acquired. Therefore, the reflective mold liquid crystal display which has a good and reproducible reflection property is realizable. Moreover, a reflective mold liquid crystal display may be constituted using the reflecting plate which has each modification about crevice arrangement of the gestalt 1 of operation, and the reflecting plate of the gestalten 2-4 of operation, and the same effectiveness is acquired.
With the gestalten 1-5 of the gestalt 6 above-mentioned implementation of operation, good visibility was acquired by the reflected light's diffracting with the irregularity of the front face of a reflecting plate, and controlling the phenomenon in which the diffracted light interferes by arrangement of regular irregularity. Interference of this diffracted light is produced also when consisting of a flat surface where reflection, transparency, refraction, etc. carry out light which carried out incidence. Therefore, this invention is effective not only in the irregularity of a reflecting plate but controlling that the diffracted light

interferes when it has been arranged so that a refractive index, permeability, etc. may repeat in a mode with this same distribution in the optical member distributed in a flat surface.

[0125] For example, it is applicable to the optical member over which light is scattered, the so-called dispersion film, and the optical member which the minute field which shades light is arranged [member] to a transparent member, and makes it decrease light.

(Example 1) The example 1 of this invention illustrates the optical member over which light is scattered. Drawing 22 is the sectional view showing the configuration of the optical member concerning this example.

[0126] As shown in drawing 22 , the optical member 503 concerning this example consists of the upper layers 502 and the lower layers 501 which consist of the transparent quality of the material which is two kinds from which a refractive index differs mutually. And the interface 504 of the upper layer 502 and a lower layer 501 has the shape of same toothing as the front face of the reflecting plate of the gestalten 1-4 of operation. Moreover, inferior-surface-of-tongue 501of top-face [of the upper layer 502] and lower layer 501 a is both formed evenly in parallel with **.

[0127] That from which a refractive index differs can be used for the upper layer 502 and a lower layer 501 out of transparent matter, such as transparence resin, such as glass, a nitride, an indium stannic acid ghost (ITO), and acrylic resin, an epoxy resin, choosing it suitably. A lower layer 501 consists of glass and the upper layer 502 is constituted from this example by acrylic resin, respectively. In this optical member 503, if light carries out incidence to either top-face 502a of the upper layer 502, and inferior-surface-of-tongue 501a of a lower layer 501, since the interface 504 of the upper layer 502 and a lower layer 501 has the field which inclined to top-face 502a of the upper layer 502, and inferior-surface-of-tongue 501a of a lower layer 501, that light that carried out incidence will be refracted by the interface 504, and they will be scattered about according to the shape of that toothing.

[0128] Thus, by the inclination of an interface 504, the optical property (here dispersion property) to the direction of a station of the optical member 503 changes in the extension side of this optical member 503, and has large and small distribution. And the point that an optical property serves as the maximum or the minimum according to the inclination of the interface 504 by the irregularity is arranged in the extension side of the optical member 503. On these specifications, an optical property calls in a field the point of taking the maximum or minimum extremal value the optical center of action. The optical center of action is not the point of taking the maximum within [whole] a field, or the minimum value but the point that distribution of a property takes the extremal value of the part distributed like a crest or a trough. In this example, the bottom of the crevice of the interface 504 in the sectional view of drawing 22 is the optical center of action 505. When the optical center of action 505 has been arranged regularly, and interference of the light by diffraction occurs and it sees from a specific direction like the reflecting plate which has the irregularity shown in drawing 19 and the conventional example of drawing 20 , the fault that light looks strong, or it colors and is visible arises. However, when it is going to arrange the optical center of action at random that the fault should be canceled and there is no regularity in the arrangement, the property of an optical member may change depending on a designer. Then, in the case of the optical member 503 of this example as well as the reflecting plate of the gestalten 1-4 of operation, the optical center of action is arranged according to a predetermined regulation in a flat surface, and a reproducible design can be performed, while controlling interference of the diffracted light and being able to acquire a good dispersion property by making irregular arrangement of the optical center of action on the straight line of the arbitration within a flat surface.

[0129] Moreover, by arranging the optical member of this example on the front face of the reflective mold display which has a flat metallic reflection plate, reflected [the light source with a metallic reflection plate] can be controlled, and the reflective mold display which has a good dispersion property can be offered.

[0130] Drawing 23 is drawing showing the manufacture approach of the optical member of drawing 22 , and (a) - (d) is the sectional view according to process showing each process.

[0131] In order to manufacture an optical member, as it is first shown in drawing 23 (a), it is the photoresist 506 of a positive type on flat glass substrate 501'. It applies, and after that, mask exposure is carried out with the photo mask 15 with which light transmission field 15a was formed in the part which should form a crevice, and protection-from-light field 15b was formed in the other part, respectively, and, thereby, the part corresponding to the above-mentioned translucent part 15b of a photoresist 506 is exposed.
[0132] Subsequently, negatives are developed to this glass substrate 501' by which mask exposure was carried out, and this forms opening 507 in the above-mentioned sensitization part of a photoresist 506, as shown in drawing 23 (b).
[0133] Subsequently, by etching glass substrate 501' by fluoric acid by using this photoresist 506 as a mask, as shown in drawing 23 (c), the front face of glass substrate 501' is melted, irregularity is formed, and a lower layer 501 is obtained.
[0134] Subsequently, a photoresist 506 is exfoliated, and after that, as acrylic resin is applied and stiffened on a lower layer 501 and it is shown in drawing 22 (d), the upper layer 502 is formed. Thereby, the optical member 503 is obtained. Thus, by the photolithography method, the optical member 503 of this example can be obtained easily.
[0135] The photo mask 15 for performing the above-mentioned mask exposure designs arrangement of protection-from-light field 15b or light transmission field 15a so that it may become physical relationship [**** / concentric circular regular arrangement] on the plane coordinates of arbitration. By carrying out like this, the optical center of action of an optical member can be considered as concentric circular regular arrangement, and the effectiveness of this invention can be acquired. And arrangement of the optical center of action may have physical relationship [**** / the arrangement obtained on the plane coordinates of arbitration by carrying out symmetric transformation of two or more points of having concentric circular arrangement]. Here, symmetric transformation means rotation of a certain shaft of a surrounding fixed include angle, the reflection in a certain straight line, and one approach of the parallel displacements. Or what performed conversion which combined such symmetric transformation is said.
[0136] More specifically, arrangement of the optical center of action can be made into approximately concentric, an abbreviation swirl, an abbreviation radial, an abbreviation ellipse swirl, and an abbreviation ellipse radial like arrangement of the crevice or heights shown in the gestalten 1-4 of operation. Moreover, when a number n is given in order of the distance from a spiral core, the central angle of the n-th and the n+1st between is the multiple which is 137.5 degrees, and it can consider as arrangement including the physical relationship to which the distance from a spiral core to the optical center of action is proportional to the square root of n.
(Example 2) Drawing 24 is the sectional view showing the configuration of the optical member concerning the example 2 of this invention. in drawing 24 , it has much minute openings 604 in a predetermined location on the substrate 601 transparent [the optical member 603 concerning this example], and flat -- as -- the protection-from-light layer 602 -- preparing -- while the minute light transmission field of a large number which penetrate incident light to opening 604 is formed by that cause, the protection-from-light field which shades incident light is formed and constituted by the other part. If light carries out incidence to the optical member 603, since only the part will pass through the minute light transmission field 604 and others will be interrupted in a protection-from-light field by this, the quantity of light declines. Since such an optical member 603 attenuates this when the quantity of light of the light source is strong, it is arranged by it in front of the light source. Incident light can be made to penetrate in this optical member 603 according to the area of the minute light transmission field 604.
[0137] Here, when the minute light transmission field 604 is regularly arranged by regular intervals, the light diffracted around the minute light transmission field 604 interferes, like the case of the reflecting plate which has irregularity, light will penetrate strongly in the specific direction, or coloring will occur in a transmitted light. Then, while arranging the optical center of action 605 of the minute light

transmission field 604 on the principal plane of a substrate 601 according to a predetermined regulation, by arranging irregularly the above-mentioned optical center of action 605 on the straight line of the arbitration in this principal plane in that case, interference of the diffracted light is controlled and the good transmitted light without coloring can be obtained.

[0138] Moreover, the optical property in this example is permeability so that clearly from the above explanation. Moreover, the protection-from-light layer 602 can be easily formed by the photolithography method. At this time, by designing a photo mask by the same approach as an example 1, the optical center of action of an optical member can be made arrangement so that the effectiveness of this invention may be acquired.

[0139] Moreover, in drawing 24 , the optical member which is made to decrease the quantity of light and reflects the light which carried out incidence can be constituted by replacing with the minute light transmission field 604, and forming the minute field equipped with the reflective film which reflects incident light.

[0140] When a refractive index, permeability, a reflection factor, etc. arrange the optical center of action of each optical property in an optical member with distribution like the above examples 1 and 2 according to this invention in the extension side as an optical property, the effectiveness which controls interference of the diffracted light can be acquired.

The gestalt 7 of operation of gestalt 7 this invention of operation illustrates various kinds of optical instruments adapting the optical member of the gestalt 6 of operation. That is, a reflective mold liquid crystal display and a display like EL display can be offered by adding the display means for displaying on the optical member of the gestalt 6 of operation. Moreover, the lighting system which performs field luminescence can be offered by adding a luminescence means to the optical member. Furthermore, in the optical member, the plotting boards, such as the lightning plotting board and a traffic sign, can be offered by constituting so that the optical center of action may be distributed in the pattern to display, and adding a luminescence means. Hereafter, this is illustrated concretely.

(Example 3) Drawing 25 is the block diagram showing the configuration of the reflective mold liquid crystal display as an indicating equipment concerning the example 3 of this invention. As shown in drawing 25 , the reflective mold liquid crystal display 901 concerning this example While arranging the optical member 503 of the example 1 of the gestalt 6 of operation using the reflective mold liquid crystal display component 902 which comes to form reflective film 3' evenly in the liquid crystal display component (refer to drawing 4) of the gestalt 1 of operation in the front face of the reflective mold liquid crystal display component 902 The source line SL and the gate line GL are driven by the source drive circuit 402 and the gate drive circuit 403, respectively, and it constitutes so that the source drive circuit 402 and the gate drive circuit 403 may be controlled by the digital disposal circuit 401. If it is such a configuration, specular reflection of the outdoor daylight which carried out incidence to the reflective mold liquid crystal display component 902 will be carried out by the flat reflective film, but since it is scattered about by the optical member 503 in the case of the incidence and reflection, it has a wide-field-of-view angle property. And the wide-field-of-view angle property has the repeatability of a design.

(Example 4) Drawing 26 is the mimetic diagram showing the configuration of the lighting system concerning the example 4 of this invention. As shown in drawing 26 , the lighting system 1001 concerning this example arranges the optical member 503 of the example 1 of the gestalt 6 of operation before the luminescence means 1002 which consists of sources of non-sheet-like light, such as a lamp. Since it will be scattered about in case the light emitted from the luminescence means 1002 passes the optical member 503 if it is such a configuration, the lighting system which performs field luminescence in a good diffusion property can be offered. And the property of the field luminescence has the repeatability of a design.

(Example 5) Drawing 27 is the front view showing the configuration of the plotting board concerning the example 5 of this invention. In drawing 27 , the optical member 603 of the example 2 of the gestalt 6 of

operation before the luminescence means 1102 is arranged, and in the optical member 603, the plotting board 1101 concerning this example is constituted so that the optical center of action may be distributed in a display pattern 1103. When it is such a configuration, the minute light transmission field from which the light by which outgoing radiation was carried out from the luminescence means 1102 is distributed in the pattern 1103 of the optical member 603 is penetrated, and, thereby, a display pattern 1103 emits light and appears. Therefore, the plotting boards which are not produced, such as coloring, can be offered. And the luminescence property of the display pattern has the repeatability of a design. Although the gestalten 1-7 of eight or more gestalten [of operation] operation showed the example of application to the optical instrument of this invention, since interference of the diffracted light is controlled, if it is the wave motion, it is effective [this invention], without asking exceptions, such as not only light but an acoustic wave, an electromagnetic wave, an oscillatory wave, etc. Therefore, the sound member which applied this invention also to these, the Radio Department material, an electromagnetic wave member, and an oscillating member can be constituted. That is, when it controls that a specific period or the wave of a frequency suits in slight strength and a wave reflects or penetrates by the configuration of this invention, the member which presents a uniform property can be offered. Moreover, on these specifications, the concept of the optical center of action which the gestalt 6 of operation defined is extended, and the concept of the undulatory center of action is used. Here, the undulatory center of action means in a field the point within the field where the property about the wave motion takes the maximum or minimum extremal value. It follows, and when wave motion is sound, an electric wave, an electromagnetic wave, and vibration, the undulatory center of action points out the sound center of action, the electric-wave center of action, the electromagnetic wave center of action, and the oscillating center of action, respectively. Moreover, specifically, the property about the wave motion points out properties, such as reflection of the wave motion, refraction, and transparency. Hereafter, this is illustrated concretely.

(Example 6) Drawing 28 is the front view showing the configuration of the sound member concerning the example 6 of this invention. As shown in drawing 28 , the minute echo field 1112 with which the front face of the acoustic material with which a front face absorbs a sound echoes a sound is formed, and the sound member 1111 concerning this example is constituted. Depending on the area of the minute echo field 1112, extent with which a sound echoes is controllable by this sound member 1111. The sound member which controls that the sound of a specific frequency suits in slight strength, and has a uniform acoustic feature can be offered by considering arrangement of the sound center of action of this minute echo field as arrangement [**** / the optical center of action shown in the gestalt 6 of operation]. A good sound room can be constituted by preparing a sound member in the wall surface of a sound room etc.

(Example 7) Among wave motion, to the specific observation direction, since the wave of a certain frequency suits in slight strength, a failure may be encountered also in an electric wave, an electromagnetic wave, and vibration. For example, through radio in the sensibility failure of the image sensor which measures by the sensibility to an electromagnetic wave in the radio disturbance and the electromagnetic wave with which reception of the public address system mingles, and vibration, they are failures, such as strong propagation of vibration to a specific direction, etc. The member which controls the failure by a wave suiting in slight strength by the configuration of this invention which arranges distribution of the field or the property of having a different property like this invention, based on a predetermined regulation, and has a uniform wave-motion property can be offered.

[0141] The front view showing the configuration of the electromagnetic wave member which drawing 29 requires for the example 7 of this invention, the front view showing the configuration of the oscillating member which drawing 30 requires for the example 7 of this invention, and drawing 31 are the front views showing the configuration of the Radio Department material concerning the example 7 of this invention. in these drawings, the electromagnetic wave member 1121, the oscillating member 1131, and the Radio Department material 1141 are minute respectively -- electromagnetism -- the operation field

1122, the oscillating operation field 1132, and the minute electrical-and-electric-equipment operation field 1142 are formed in the extension side. minute -- electromagnetism -- the operation field 1122, the minute oscillating operation field 1132, and the minute electrical-and-electric-equipment operation field 1142 are the field where properties, such as an electromagnetic wave, vibration, a reflection factor about an electric wave, permeability, a refractive index, and intensity of radiation, change a crest or in the shape of a trough into the extension side of each part material 1121, 1131, and 1141, i.e., the field near the maximum point, and a field near the minimum point, respectively. these -- minute -- electromagnetism -- arrangement of the center of action of the operation field 1122, the minute oscillating operation field 1132, and the minute electrical-and-electric-equipment operation field 1142 is arrangement [**** / the optical center of action shown in the gestalt 6 of operation].

[0142] In addition, although the reflecting plate, the optical member, and the wave-motion member explained the case where the configuration was a plane, with the gestalten 1-8 of the above-mentioned implementation, these may be curved surfaces-like. That is, since an interference according [the curvature of the member used as a wave source] to the diffraction of a wave as compared with the wavelength of the wave motion when large arises, in such a case as well as the case where the member used as a wave source is a plane, this invention is applicable.

[0143]

[Effect of the Invention] This invention is carried out according to the above gestalt, and the effectiveness that the reflecting plate which can design the wave-motion radiation member of the two-dimensional configuration which has the fixed radiation property which can control interference of the wave motion to emit and its manufacture approach, a reflective mold liquid crystal display and its manufacture approach, an optical member, a display, a lighting system, the plotting board, and a list can be provided with a wave-motion member is done so.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the top view showing the configuration of the reflecting plate concerning the gestalt 1 of operation of this invention.

[Drawing 2] It is the II-II sectional view of drawing 1 .

[Drawing 3] It is the top view showing the configuration of the reflective mold liquid crystal display component concerning the gestalt 1 of operation of this invention.

[Drawing 4] It is the IV-IV sectional view of drawing 2 .

[Drawing 5] It is drawing showing arrangement according to the regulation of the crevice of the reflecting plate of drawing 1 and drawing 3 .

[Drawing 6] It is drawing showing the manufacture approach of the reflecting plate of drawing 1 , and (a) - (d) is the sectional view according to process showing each process.
[Drawing 7] It is the top view showing the configuration of the reflecting plate concerning the gestalt 2 of operation of this invention.
[Drawing 8] It is the VIII-VIII sectional view of drawing 7 .
[Drawing 9] It is the top view showing the configuration of the reflecting plate concerning the gestalt 3 of operation of this invention.
[Drawing 10] It is the X-X sectional view of drawing 9 .
[Drawing 11] It is the XI-XI sectional view of drawing 9 .
[Drawing 12] It is the top view showing the example of 1 configuration of the reflecting plate concerning the gestalt 4 of operation of this invention.
[Drawing 13] It is the top view showing other examples of a configuration of the reflecting plate concerning the gestalt 4 of operation of this invention.
[Drawing 14] It is the top view showing the modification of crevice arrangement of the reflecting plate of the gestalt 1 of operation of this invention.
[Drawing 15] It is the top view showing other modifications of crevice arrangement of the reflecting plate of the gestalt 1 of operation of this invention.
[Drawing 16] It is the top view showing the modification of crevice arrangement of the pixel reflecting plate of the reflective mold liquid crystal display of the gestalt 1 of operation of this invention.
[Drawing 17] It is the top view showing other modifications of crevice arrangement of the pixel reflecting plate of the reflective mold liquid crystal display of the gestalt 1 of operation of this invention.
[Drawing 18] It is the top view showing the further modification of crevice arrangement of the pixel reflecting plate of the reflective mold liquid crystal display of the gestalt 1 of operation of this invention.
[Drawing 19] It is the top view showing an example of concavo-convex arrangement of the conventional reflecting plate.
[Drawing 20] It is the XX-XX sectional view of drawing 19 .
[Drawing 21] It is the block diagram showing the configuration of the reflective mold liquid crystal display concerning the gestalt 5 of operation of this invention.
[Drawing 22] It is the sectional view showing the configuration of the optical member concerning the example 1 of the gestalt 6 of operation of this invention.
[Drawing 23] It is drawing showing the manufacture approach of the optical member of drawing 22 , and (a) - (d) is the sectional view according to process showing each process.
[Drawing 24] It is the sectional view showing the configuration of the optical member concerning the example 2 of the gestalt 6 of operation of this invention.
[Drawing 25] It is the block diagram showing the configuration of the reflective mold liquid crystal display as an indicating equipment concerning the example 3 of the gestalt 7 of operation of this invention.
[Drawing 26] It is the mimetic diagram showing the configuration of the lighting system concerning the example 4 of the gestalt 7 of operation of this invention.
[Drawing 27] It is the front view showing the configuration of the plotting board concerning the example 5 of the gestalt 7 of operation of this invention.
[Drawing 28] It is the front view showing the configuration of the sound member concerning the example 6 of the gestalt 8 of operation of this invention.
[Drawing 29] It is the front view showing the configuration of the electromagnetic wave member concerning the example 7 of the gestalt 8 of operation of this invention.
[Drawing 30] It is the front view showing the configuration of the oscillating member concerning the example 7 of the gestalt 8 of operation of this invention.
[Drawing 31] It is the front view showing the configuration of the Radio Department material concerning the example 7 of the gestalt 8 of operation of this invention.
[Description of Notations]

1 Substrate
2 Concavo-convex Layer
3 Reflective Film
3' pixel reflective film
4 4a Crevice
6 Switching Element
6a Connection terminal
7 Contact Hole
9 Common Electrode
10 Color Filter
11 Substrate
12 Phase Contrast Plate
13 Polarizing Plate
14 Liquid Crystal
15 Photo Mask
15a Light transmission field
15b Protection-from-light field
16 Opening
101,101' Reflecting plate
102,902 Reflective mold liquid crystal display component
103 Opposite Substrate
201 Pixel
202 Field equivalent to Pixel Reflective Film
400,901 Reflective mold liquid crystal display
401 Digital Disposal Circuit
402 Source Drive Circuit
403 Gate Drive Circuit
501 Lower Layer
501' Glass substrate
501a A lower layer inferior surface of tongue
502 Upper Layer
502a The upper top face
503,603 Optical member
504 Interface
505,605 Optical center of action
506 Photoresist
507 Opening
601 Substrate
602 Protection-from-Light Layer
604 Minute Light Transmission Field
1001 Lighting System
1002 Luminescence Means
1101 Plotting Board
1103 Display Pattern
1111 Sound Member
1112 Minute Echo Field
1121 Electromagnetic Wave Member
1122 Minute -- Electromagnetism -- Operation Field
1131 Oscillating Member

1132 Minute Oscillating Operation Field
1141 Radio Department Material
1142 Minute Electrical-and-Electric-Equipment Operation Field
C Center
GL Gate line
SL Source line

[Translation done.]

(19)日本国特許庁（ＪＰ）　(12)公開特許公報（A）　(11)特許出願公開番号
特開2002－14211
（P2002－14211A）
(43)公開日　平成14年１月18日(2002.1.18)

(51)Int.Cl.[7]		識別記号	FI			テーマコード(参考)
G02B	5/08		G02B	5/08	B	2H042
					A	2H091
					C	
	5/02			5/02	C	
G02F	1/1335	520	G02F	1/1335	520	

審査請求　未請求　請求項の数56　ＯＬ　（全 21 頁）

(21)出願番号　特願2001－116619(P2001－116619)
(22)出願日　平成13年４月16日(2001.4.16)
(31)優先権主張番号　特願2000－122728(P2000－122728)
(32)優先日　平成12年４月24日(2000.4.24)
(33)優先権主張国　日本（ＪＰ）

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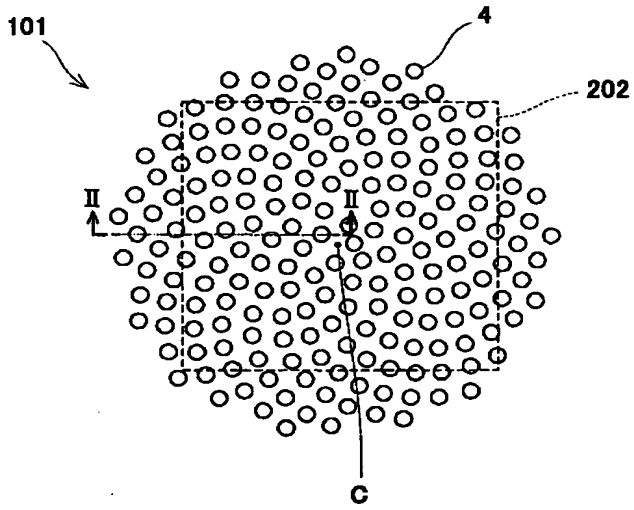
Ｆターム(参考)　2H042 BA04 BA12 BA15 BA20 DA02
DA04 DA11 DD10 DE04
2H091 FA16Y FC19 FC26 LA18
LA19 LA21

(54)【発明の名称】　反射板、反射型液晶表示装置及びその製造方法、光学部材、表示装置、照明装置、表示板、並びに波動部材

(57)【要約】
【課題】　放射する波動の干渉を抑制することが可能でかつ一定の放射特性を有する２次元形状の波動放射部材を設計することが可能な反射板及びその製造方法、反射型液晶表示装置及びその製造方法、光学部材、表示装置、照明装置、表示板、並びに波動部材を提供する。
【解決手段】　表面に凹凸形状を有する反射板101において、上記凹凸形状の凹部４の少なくとも一部が所定の規則に従って配置され、任意の互いに平行な直線状断面における該凹凸形状に互いに同じ規則性が現れないものである。



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【特許請求の範囲】

【請求項１】　面に凹凸形状を有する反射板において、上記凹凸形状の凹部又は凸部の少なくとも一部が所定の規則に従って配置され、任意の直線状断面における上記凹凸形状が不規則であることを特徴とする反射板。

【請求項２】　表面に凹凸形状を有する反射板において、

上記凹凸形状の凹部又は凸部の少なくとも一部が所定の規則に従って配置され、任意の互いに平行な直線状断面における該凹凸形状に互いに同じ規則性が現れないことを特徴とする反射板。

【請求項３】　上記凹凸形状の凹部又は凸部の少なくとも一部が略らせん状に配置されてなることを特徴とする請求項１又は２記載の反射板。

【請求項４】　上記らせんの中心からの距離の順に凹部又は凸部に番号ｎを付与したとき、ｎ番目とｎ＋１番目との間の中心角が１３７．５度の倍数である凹部又は凸部を含むことを特徴とする請求項３記載の反射板。

【請求項５】　上記らせんの中心からの距離の順に凹部又は凸部に番号ｎを付与したとき、らせんの中心から凹部又は凸部までの距離がｎの平方根に比例する凹部又は凸部を含むことを特徴とする請求項３記載の反射板。

【請求項６】　上記凹凸形状の凹部又は凸部の少なくとも一部が略同心円状に規則的に配置されてなることを特徴とする請求項１又は２記載の反射板。

【請求項７】　上記凹凸形状の凹部又は凸部の少なくとも一部が略放射状に配置されてなることを特徴とする請求項１又は２記載の反射板。

【請求項８】　上記凹凸形状の凹部又は凸部の少なくとも一部が略楕円らせん状又は略楕円放射状に配置されてなることを特徴とする請求項１又は２記載の反射板。

【請求項９】　上記凹凸形状の凹部又は凸部の少なくとも一部が、任意の平面座標上でｎを自然数とし上記座標の原点からの半径をｎの平方根、位相角を１３７．５度のｎ倍として得られた上記平面座標上の複数の点と相似な位置関係を有するよう配置されてなることを特徴とする請求項１又は２記載の反射板。

【請求項１０】　全ての上記凹部又は凸部のうちの５割以上のものが、上記所定の規則に従って配置されたものである請求項１又は２記載の反射板。

【請求項１１】　上記凹凸形状の凹部又は凸部の配置が、マトリクス状に繰り返し配置されてなる請求項１記載の反射板。

【請求項１２】　上記凹凸形状の凹部又は凸部が、その少なくとも一部が所定の規則に従って配置された遮光領域又は透光領域を含むフォトマスクを用いたマスク露光及び現像を含む処理を経て形成されたものであることを特徴とする請求項１又は２記載の反射板。

【請求項１３】　凹凸形状を有する複数の単位領域が表面に形成された反射板において、

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全ての上記単位領域の凹凸形状が同じであり、

かつある上記単位領域の凹凸形状の凹部又は凸部の少なくとも一部が所定の規則に従って配置され、任意の互いに平行な直線状断面における該凹凸形状に互いに同じ規則性が現れないことを特徴とする反射板。

【請求項１４】　上記単位領域がマトリクス状に表面に形成されてなることを特徴とする請求項１３記載の反射板。

【請求項１５】　表面に凹凸形状を有する反射板の製造方法において、

その凹部又は凸部の少なくとも一部の配置が所定の規則に従い、かつその任意の直線状断面において不規則になるように上記凹凸形状を形成することを特徴とする反射板の製造方法。

【請求項１６】　その少なくとも一部が所定の規則に従い、かつその配置面内における任意の直線状上において不規則になるよう配置された遮光領域又は透光領域を含むフォトマスクを用いたマスク露光及び現像を含む処理を行い、それにより表面に該フォトマスクの遮光領域又は透光領域に対応する位置に凹部又は凸部を有する凹凸形状を基板上に形成する工程と、

該凹凸形状上に反射膜を形成する工程とを含むことを特徴とする請求項１５記載の反射板の製造方法。

【請求項１７】　表面に凹凸形状を有する反射板の製造方法において、

その凹部又は凸部の少なくとも一部の配置が所定の規則に従い、かつその任意の互いに平行な直線状断面において同じ規則性が繰り返し現れないように上記凹凸形状を形成することを特徴とする反射板の製造方法。

【請求項１８】　その少なくとも一部が所定の規則に従い、かつその配置面内における任意の互いに平行な直線上において同じ規則性が現れないよう配置された遮光領域又は透光領域を含むフォトマスクを用いたマスク露光及び現像を含む処理を行い、それにより表面に該フォトマスクの遮光領域又は透光領域に対応する位置に凹部又は凸部を有する凹凸形状を基板上に形成する工程と、

該凹凸形状上に反射膜を形成する工程とを含むことを特徴とする請求項１７記載の反射板の製造方法。

【請求項１９】　液晶層と、該液晶層に略平行に配置された反射板とを備え、外光が該液晶層を介して該反射板で外部に反射され、かつ該液晶層を外部から印加する電圧で変調可能なように構成された液晶表示素子において、

上記反射板が、表面に凹凸形状を有し、該凹凸形状の凹部又は凸部の少なくとも一部が所定の規則に従って配置され、任意の直線状断面における上記凹凸形状が不規則であることを特徴とする反射型液晶表示素子。

【請求項２０】　液晶層と、該液晶層に略平行に配置された反射板とを備え、外光が該液晶層を介して該反射板で外部に反射され、かつ該液晶層を外部から印加する電

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圧で変調可能なように構成された液晶表示素子において、

上記反射板が、表面に凹凸形状を有し、該凹凸形状の凹部又は凸部の少なくとも一部が所定の規則に従って配置され、任意の互いに平行な直線状断面における該凹凸形状に互いに同じ規則性が現れないものであることを特徴とする反射型液晶表示素子。

【請求項２１】　上記反射板は基板上に上記外光を反射する反射膜が形成されてなり、該反射板と上記液晶層を介して対向するように対向基板が配置され、上記液晶層を変調するための電極を上記反射膜と上記対向基板の内面に形成された共通電極とが構成してなることを特徴とする請求項１９又は２０記載の反射型液晶表示素子。

【請求項２２】　その少なくとも一部が所定の規則に従い、かつその配置面内における任意の直線状上において不規則になるよう配置された遮光領域又は透光領域を含むフォトマスクを用いたマスク露光及び現像を含む処理を行い、それにより表面に該フォトマスクの遮光領域又は透光領域に対応する位置に凹部又は凸部を有する凹凸形状を基板上に形成する工程と、

該凹凸形状上に反射膜を形成する工程と、

上記基板の該反射膜が形成された面に対向するように、内面に共通電極が形成された対向基板を配置する工程と、

上記基板と該対向基板との間に液晶を封入する工程とを含むことを特徴とする反射型液晶表示素子の製造方法。

【請求項２３】　その少なくとも一部が所定の規則に従い、かつその配置面内における任意の互いに平行な直線上において同じ規則性が現れないよう配置された遮光領域又は透光領域を含むフォトマスクを用いたマスク露光及び現像を含む処理を行い、それにより表面に該フォトマスクの遮光領域又は透光領域に対応する位置に凹部又は凸部を有する凹凸形状を基板上に形成する工程と、

該凹凸形状上に反射膜を形成する工程と、

上記基板の該反射膜が形成された面に対向するように、内面に共通電極が形成された対向基板を配置する工程と、

上記基板と該対向基板との間に液晶を封入する工程とを含むことを特徴とする反射型液晶表示素子の製造方法。

【請求項２４】　液晶層及び該液晶層に略平行に配置された反射板を有し、外光が該液晶層を介して該反射板で外部に反射されるとともに該液晶層を外部から印加する電圧で変調可能なように構成され、上記反射板が、表面に凹凸形状を有し、該凹凸形状の凹部又は凸部の少なくとも一部が所定の規則に従って配置され、かつ任意の直線状断面における上記凹凸形状が不規則である反射型液晶表示素子と、

上記液晶層を変調するための電圧を印加して該反射型液晶表示素子を駆動する駆動手段とを備えた反射型液晶表示装置。

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【請求項２５】　液晶層及び該液晶層に略平行に配置された反射板を有し、外光が該液晶層を介して該反射板で外部に反射されるとともに該液晶層を外部から印加する電圧で変調可能なように構成され、上記反射板が、表面に凹凸形状を有し、該凹凸形状の凹部又は凸部の少なくとも一部が所定の規則に従って配置され、かつ任意の互いに平行な直線状断面における該凹凸形状に互いに同じ規則性が現れないものである反射型液晶表示素子と、

上記液晶層を変調するための電圧を印加して該反射型液晶表示素子を駆動する駆動手段とを備えた反射型液晶表示装置。

【請求項２６】　観測点方向に対する光学特性が面内で変化し、該光学特性が極大又は極小をなす光学作用中心の少なくとも一部が上記面内で所定の規則に従って配置され、上記面内の任意の直線上における上記光学作用中心の配置が不規則であることを特徴とする光学部材。

【請求項２７】　観測点方向に対する光学特性が面内で変化し、該光学特性が極大又は極小をなす光学作用中心の少なくとも一部が上記面内で所定の規則に従って配置され、上記面内の任意の互いに平行な直線上における上記光学作用中心の配置に互いに同じ規則性が現れないことを特徴とする光学部材。

【請求項２８】　上記光学特性が上記光学作用中心を中心とする微小領域と残りの領域との間で略不連続に変化し、かつ各領域において略一定値を有してなることを特徴とする請求項２６又は２７記載の光学部材。

【請求項２９】　上記光学作用中心の少なくとも一部が略らせん状に配置されてなることを特徴とする請求項２６又は２７記載の光学部材。

【請求項３０】　上記らせんの中心からの距離の順に光学作用中心に番号ｎを付与したとき、ｎ番目とｎ＋１番目との間の中心角が１３７．５度の倍数である光学作用中心を含むことを特徴とする請求項２９記載の光学部材。

【請求項３１】　上記らせんの中心からの距離の順に光学作用中心に番号ｎを付与したとき、らせんの中心から光学作用中心までの距離がｎの平方根に比例する光学作用中心を含むことを特徴とする請求項２９記載の光学部材。

【請求項３２】　上記光学作用中心の少なくとも一部が略同心円状に規則的に配置されてなることを特徴とする請求項２６又は２７記載の光学部材。

【請求項３３】　上記光学作用中心の少なくとも一部が略放射状に配置されてなることを特徴とする請求項２６又は２７記載の光学部材。

【請求項３４】　上記光学作用中心の少なくとも一部が略楕円らせん状又は略楕円放射状に配置されてなることを特徴とする請求項２６又は２７記載の光学部材。

【請求項３５】　上記光学作用中心の少なくとも一部が、任意の平面座標上でｎを自然数とし上記座標の原点

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からの半径をｎの平方根、位相角を１３７．５度のｎ倍として得られた上記平面座標上の複数の点と相似な位置関係を有するように配置されてなることを特徴とする請求項２６又は２７記載の光学部材。

【請求項３６】　上記光学作用中心の少なくとも一部が、任意の平面座標上で同心円状に規則的に配置された複数の点を対称変換して得られた配置と相似な位置関係を有するように配置されてなることを特徴とする請求項２６又は２７記載の光学部材。

【請求項３７】　上記光学作用中心の配置が、マトリクス状に繰り返し配置されてなる請求項２６又は２７記載の光学部材。

【請求項３８】　上記光学特性が反射率であることを特徴とする請求項２６又は２７記載の光学部材。

【請求項３９】　上記光学特性が屈折率であることを特徴とする請求項２６又は２７記載の光学部材。

【請求項４０】　上記光学特性が透過率であることを特徴とする請求項２６又は２７記載の光学部材。

【請求項４１】　観測点方向に対する光学特性が面内で複数の単位領域毎に変化し、全ての該単位領域の光学特性が同じであり、かつある該単位領域における該光学特性が極大又は極小をなす光学作用中心の少なくとも一部が該単位領域の面内で所定の規則に従って配置され、該単位領域の面内の任意の互いに平行な直線上における上記光学作用中心の配置に互いに同じ規則性が現れないことを特徴とする光学部材。

【請求項４２】　上記単位領域がマトリクス状に面内に形成されてなることを特徴とする請求項４１記載の光学部材。

【請求項４３】　所定の情報を表示する表示手段と、該情報を表示するための光の光路上に配置され、該表示される情報を観測する方向に対する光学特性が面内で変化し、該光学特性が極大又は極小をなす光学作用中心の少なくとも一部が上記面内で所定の規則に従って配置され、上記面内の任意の直線上における上記光学作用中心の配置が不規則である光学部材とを備えたことを特徴とする表示装置。

【請求項４４】　所定の情報を表示する表示手段と、該情報を表示するための光の光路上に配置され、該表示される情報を観測する方向に対する光学特性が面内で変化し、該光学特性が極大又は極小をなす光学作用中心の少なくとも一部が上記面内で所定の規則に従って配置され、上記面内の任意の互いに平行な直線上における上記光学作用中心の配置に互いに同じ規則性が現れない光学部材とを備えたことを特徴とする表示装置。

【請求項４５】　光を発する発光手段と、該発せられる光の光路上に配置され、該表示される情報を観測する方向に対する光学特性が面内で変化し、該光学特性が極大又は極小をなす光学作用中心の少なくとも一部が上記面内で所定の規則に従って配置され、上記面

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内の任意の直線上における上記光学作用中心の配置が不規則である光学部材とを備えたことを特徴とする照明装置。

【請求項４６】　光を発する発光手段と、該発せられる光の光路上に配置され、該表示される情報を観測する方向に対する光学特性が面内で変化し、該光学特性が極大又は極小をなす光学作用中心の少なくとも一部が上記面内で所定の規則に従って配置され、上記面内の任意の互いに平行な直線上における上記光学作用中心の配置に互いに同じ規則性が現れない光学部材とを備えたことを特徴とする照明装置。

【請求項４７】　光を発する発光手段と、該発せられる光の光路上に配置され、該表示される情報を観測する方向に対する光学特性が面内で変化し、該光学特性が極大又は極小をなす光学作用中心の少なくとも一部が上記面内で所定の規則に従って配置され、上記面内の任意の直線上における上記光学作用中心の配置が不規則であり、かつ上記光学作用中心が所定の表示パターン内に分布するよう配置されてなる光学部材とを備えたことを特徴とする表示板。

【請求項４８】　光を発する発光手段と、該発せられる光の光路上に配置され、該表示される情報を観測する方向に対する光学特性が面内で変化し、該光学特性が極大又は極小をなす光学作用中心の少なくとも一部が上記面内で所定の規則に従って配置され、上記面内の任意の互いに平行な直線上における上記光学作用中心の配置に互いに同じ規則性が現れず、かつ上記光学作用中心が所定の表示パターン内に分布するよう配置されてなる光学部材とを備えたことを特徴とする表示板。

【請求項４９】　波動の放射特性が面内で変化し、該放射特性が極大又は極小をなす波動作用中心の少なくとも一部が上記面内で所定の規則に従って配置され、上記面内の任意の直線上における上記波動作用中心の配置が不規則であることを特徴とする波動部材。

【請求項５０】　波動の放射特性が面内で変化し、該放射特性が極大又は極小をなす波動作用中心の少なくとも一部が上記面内で所定の規則に従って配置され、上記面内の任意の互いに平行な直線上における上記波動作用中心の配置に互いに同じ規則性が現れないことを特徴とする波動部材。

【請求項５１】　上記放射特性が上記波動作用中心を中心とする微小領域と残りの領域との間で略不連続に変化し、かつ各領域において略一定値を有してなることを特徴とする請求項４９又は５０記載の波動部材。

【請求項５２】　上記波動作用中心の少なくとも一部が同心円状に規則的に配置されてなる請求項４９又は５０記載の波動部材。

【請求項５３】　上記波動が音波であり、それにより音響部材を構成してなる請求項４９又は５０記載の波動部材。

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【請求項５４】　上記波動が電磁波であり、それにより電磁波部材を構成してなる請求項４９又は５０記載の波動部材。

【請求項５５】　上記波動が振動であり、それにより振動部材を構成してなる請求項４９又は５０記載の波動部材。

【請求項５６】　上記波動が電波であり、それにより電波部材を構成してなる請求項４９又は５０記載の波動部材。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、光の反射板及びその製造方法、反射型液晶表示装置及びその製造方法、光学部材、表示装置、照明装置、表示板、並びに波動部材に関する。

【０００２】

【従来の技術】バックライト等の光源を必要としない反射型表示装置、例えば、反射型液晶表示装置は、外光を用いて表示を行うものであり、消費電力が小さく、携帯用の機器に利用することが多い。

【０００３】反射型表示装置として十分な明るさを確保するためには、反射率の高いアルミニウムや銀等の金属からなる反射板を用いることが考えられる。しかし、反射板の表面が平坦であると、鏡面反射を生じて、光源が反射板に映り込み、反射板のその光源が映った部分以外の部分はほとんど光を反射しないために暗く、表示装置の表示が非常に見づらくなる。そこで、その金属反射板の表面に微細な凹凸を多数形成し、その凹凸によって光を散乱させるようにすると、光源の映り込みが抑制され、反射率が良好な反射板を得ることができる。このような反射板を備えた反射型液晶表示装置は、特許２６９８２１８号、特許２７５６２０６号等に開示されている。

【０００４】ところで、表面に凹凸を有する反射板では、反射光の方向がその表面の形状に依存する。一方、凹凸が形成された反射板では、光が反射するときに回折する現象が起こる。そのため、凹凸が均等な間隔でくり返し配置されている場合には、反射板の表面の凹凸で回折した光が互いに干渉し、特定の方向に強い光が反射したり、特定の波長が干渉して強め合い、それにより、反射板が色づいて見える。このような凹凸形状の配置の例を図１９に示す。また、図１９のXX－XX断面を図２０に示す。図１９において、円は凹部を表している。そして、その凹部が格子状に規則的に配置されている。また、図２０おいて、この凹凸形状は基板１上に凹凸層２を利用して形成された反射膜３に形成されているが、その断面形状も規則的に凹凸が繰り返されるものとなっている。このような規則的な配置では回折した光の干渉が起こり、見づらい表示となる。そこで、反射板の延在面内における凹凸形状の配置を不規則にすると、回折光の干渉が抑制されて反射光が白色化されるので、良好な反射特性を有する反射板を得ることができる。

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【０００５】このようにして回折光の干渉を抑制する方法の一例が、特許２９１２１７６号に開示されている。この例では、凹凸が不規則に配置されている。具体的には、隣接する凹部間若しくは凸部間の距離分布、又は凹凸の高さ分布が、所定のばらつきとなるように適宜凹凸が配置されている。

【０００６】

【発明が解決しようとする課題】凹凸の配置を不規則にすることにより、回折光の干渉が解消できることは上記従来例に開示された通りである。しかし、従来は凹凸配置についての具体的な設計方法が明らかにされず、不規則の程度のみが明らかであったために、凹凸配置の設計者は、ばらつきが所定の範囲になるように試行錯誤する必要があった。そのため、マトリクス状の画素を有する表示装置について設計変更する場合、例えば画素配置を変更するとともにそれに適合する反射板を新たに設計しようとする場合等、に凹凸の配置が異なることとなってしまい、その結果、凹凸の表面の傾斜角が変わり、一定の反射特性を持った反射板を設計することができなかった。

【０００７】また、この課題は、回折した光の干渉に起因するものであるので、波動であれば、光（光波）、音波、電磁波、振動波等の別を問わずに共通に存在するものである。また、波動の干渉は、波源が２次元的に分布する場合、あるいは２次元形状の波源において波動の放射強度の極値（極大値及び極小値）を有する部分が多数点在する場合に生じ、また、入射した波動を反射、透過、屈折等する平面からなる波源である場合にも生じる。従って、これらの場合にも光の反射板と同様に上記課題が存在する。

【０００８】本発明は、上記課題を解決するためになされたもので、放射する波動の干渉を抑制することが可能でかつ一定の放射特性を有する２次元形状の波動放射部材を設計することが可能な反射板及びその製造方法、反射型液晶表示装置及びその製造方法、光学部材、表示装置、照明装置、表示板、並びに波動部材を提供することを目的としている。

【０００９】

【課題を解決するための手段】上記課題を解決するために、本発明に係る反射板は、表面に凹凸形状を有する反射板において、上記凹凸形状の凹部又は凸部の少なくとも一部が所定の規則に従って配置され、任意の直線状断面における上記凹凸形状が不規則であるものである（請求項１）。

【００１０】かかる構成とすると、凹凸形状の配置が不規則であるので、反射板で反射した回折光の干渉を解消することができ、かつ凹凸形状の配置が規則性を有するので、設計時に再現可能な反射特性を得ることができ

る。

【００１１】また、本発明に係る反射板は、表面に凹凸形状を有する反射板において、上記凹凸形状の凹部又は凸部の少なくとも一部が所定の規則に従って配置され、任意の互いに平行な直線状断面における該凹凸形状に互いに同じ規則性が現れないものである（請求項２）。

【００１２】かかる構成とすると、凹凸形状の配置の規則性が特定方向に繰り返されないので、反射板で反射した回折光の干渉を解消することができ、かつ凹凸形状の配置が規則性を有するので、設計時に再現可能な反射特性を得ることができる。

【００１３】この場合、上記凹凸形状の凹部又は凸部の少なくとも一部が略らせん状に配置されてなるものとしてもよい（請求項３）。

【００１４】かかる構成とすると、任意の互いに平行な直線状断面における凹凸形状に互いに同じ規則性が現れない配置を容易に提供できる。

【００１５】この場合、上記らせんの中心からの距離の順に凹部又は凸部に番号ｎを付与したとき、ｎ番目とｎ＋１番目との間の中心角が１３７．５度の倍数である凹部又は凸部を含むものとしてもよい（請求項４）。

【００１６】かかる構成とすると、隣接する凹部又は凸部同士の距離をほぼ等しくすることができ、均一な反射特性を持つ反射板を構成することができる。

【００１７】また、上記らせんの中心からの距離の順に凹部又は凸部に番号ｎを付与したとき、らせんの中心から凹部又は凸部までの距離がｎの平方根に比例する凹部又は凸部を含むものとしてもよい（請求項５）。

【００１８】かかる構成としても、隣接する凹部又は凸部同士の距離をほぼ等しくすることができ、均一な反射特性を持つ反射板を構成することができる。

【００１９】また、上記の場合、上記凹凸形状の凹部又は凸部の少なくとも一部が略同心円状に規則的に配置されてなるものとしてもよく（請求項６）、また、上記凹凸形状の凹部又は凸部の少なくとも一部が略放射状に配置されてなるものとしてもよく（請求項７）、さらに、上記凹凸形状の凹部又は凸部の少なくとも一部が略楕円らせん状又は略楕円放射状に配置されてなるものとしてもよい（請求項８）。

【００２０】かかる構成とすると、凹凸の配置の規則性に基づく回折光の干渉を解消することができる。

【００２１】また、上記凹凸形状の凹部又は凸部の少なくとも一部が、任意の平面座標上でｎを自然数とし上記座標の原点からの半径をｎの平方根、位相角を１３７．５度のｎ倍として得られた上記平面座標上の複数の点と相似な位置関係を有するよう配置されてなるものとしてもよい（請求項９）。

【００２２】かかる構成とすると、各凹部又は凸部が面内に占める面積をほぼ同じにすることができ、隣接する凹部又は凸部の間の距離がほぼ一定に揃った規則的な配置を実現することができる。

【００２３】また、全ての上記凹部又は凸部のうちの５割以上のものが、上記所定の規則に従って配置されたものとしてもよい（請求項１０）。

【００２４】かかる構成とすると、凹凸形状の配置を設計を容易に行うことができる。

【００２５】また、上記凹凸形状の凹部又は凸部の配置が、マトリクス状に繰り返し配置されてなるものとしてもよい（請求項１１）。

【００２６】また、上記凹凸形状の凹部又は凸部が、その少なくとも一部が所定の規則に従って配置された遮光領域又は透光領域を含むフォトマスクを用いたマスク露光及び現像を含む処理を経て形成されたものであるとしてもよい（請求項１２）。

【００２７】かかる構成とすると、良好な特性を有する反射板を容易に、かつ再現性よく製造することができる。

【００２８】本発明に係る反射板は、凹凸形状を有する複数の単位領域が表面に形成された反射板において、全ての上記単位領域の凹凸形状が同じであり、かつある上記単位領域の凹凸形状の凹部又は凸部の少なくとも一部が所定の規則に従って配置され、任意の互いに平行な直線状断面における該凹凸形状に互いに同じ規則性が現れないものである（請求項１３）。

【００２９】かかる構成とすると、単位領域のある直線状断面における凹凸形状に規則性が存在する場合は、単位領域の配置ピッチで、同じ規則性が現れることになるが、そのピッチが一定値以上でその配置の繰り返し頻度が小さい場合には、干渉がわずかとなり、実用上認識されないため、干渉による弊害を解消することができる。

【００３０】この場合、上記単位領域がマトリクス状に表面に形成されてなるものとしてもよい（請求項１４）。

【００３１】かかる構成とすると、画素を用いた反射型画像表示装置の反射板に好適なものとなる。

【００３２】また、本発明に係る反射板の製造方法は、表面に凹凸形状を有する反射板の製造方法において、その凹部又は凸部の少なくとも一部が所定の規則に従い、かつその任意の直線状断面において不規則になるように又はその任意の互いに平行な直線状断面において同じ規則性が繰り返し現れないように上記凹凸形状を形成するものである（請求項１５、１７）。

【００３３】かかる構成とすると、回折による干渉を解消可能な反射板を、再現性よく製造することができる。

【００３４】この場合、その少なくとも一部が所定の規則に従い、かつその配置面内における任意の直線状断面において不規則になるよう又は任意の互いに平行な直線上において同じ規則性が現れないよう配置された遮光領域又は透光領域を含むフォトマスクを用いたマスク露光及び現像を含む処理を行い、それにより表面に該フォト

マスクの遮光領域又は透光領域に対応する位置に凹部又は凸部を有する凹凸形状を基板上に形成する工程と、該凹凸形状上に反射膜を形成する工程とを含むようにしてもよい（請求項１６、１８）。

【００３５】かかる構成とすると、フォトリソグラフィ法を用いて容易に反射板を製造することができる。

【００３６】また、本発明に係る反射型液晶表示素子は、液晶層と、該液晶層に略平行に配置された反射板とを備え、外光が該液晶層を介して該反射板で外部に反射され、かつ該液晶層を外部から印加する電圧で変調可能なように構成された液晶表示素子において、上記反射板が、表面に凹凸形状を有し、該凹凸形状の凹部又は凸部の少なくとも一部が所定の規則に従って配置され、任意の直線状断面における該凹凸形状が不規則である又は任意の互いに平行な直線状断面における該凹凸形状に互いに同じ規則性が現れないものである（請求項１９、２０）。

【００３７】かかる構成とすると、視認性及びその設計の再現性が良好な反射型液晶表示素子を提供できる。

【００３８】この場合、上記反射板は基板上に上記外光を反射する反射膜が形成されてなり、該反射板と上記液晶層を介して対向するように対向基板が配置され、上記液晶層を変調するための電極を上記反射膜と上記対向基板の内面に形成された共通電極とが構成してなるものとしてもよい（請求項２１）。

【００３９】かかる構成とすると、反射膜を電極として使用できるため、構成を簡素化することができる。

【００４０】また、本発明に係る反射型液晶表示素子の製造方法は、その少なくとも一部が所定の規則に従い、かつその配置面内における任意の互いに平行な直線上において同じ規則性が現れないよう又は任意の互いに平行な直線上において同じ規則性が現れないよう配置された遮光領域又は透光領域を含むフォトマスクを用いたマスク露光及び現像を含む処理を行い、それにより表面に該フォトマスクの遮光領域又は透光領域に対応する位置に凹部又は凸部を有する凹凸形状を基板上に形成する工程と、該凹凸形状上に反射膜を形成する工程と、上記基板の該反射膜が形成された面に対向するように、内面に共通電極が形成された対向基板を配置する工程と、上記基板と該対向基板との間に液晶を封入する工程とを含むものである（請求項２２、２３）。

【００４１】かかる構成とすると、視認性及びその設計の再現性が良好な反射型液晶表示素子をフォトリソグラフィ法により容易に製造できる。

【００４２】また、本発明に係る反射型液晶表示装置は、液晶層及び該液晶層に略平行に配置された反射板を有し、外光が該液晶層を介して該反射板で外部に反射されるとともに該液晶層を外部から印加する電圧で変調可能なように構成され、上記反射板が、表面に凹凸形状を有し、該凹凸形状の凹部又は凸部の少なくとも一部が所定の規則に従って配置され、かつ任意の直線状断面における該凹凸形状が不規則である又は任意の互いに平行な直線状断面における該凹凸形状に互いに同じ規則性が現れないものである反射型液晶表示素子と、上記液晶層を変調するための電圧を印加して該反射型液晶表示素子を駆動する駆動手段とを備えたものである（請求項２４、２５）。

【００４３】かかる構成とすると、視認性及びその設計の再現性が良好な反射型液晶表示装置を提供できる。

【００４４】また、本発明に係る光学部材は、観測点方向に対する光学特性が面内で変化し、該光学特性が極大又は極小をなす光学作用中心の少なくとも一部が上記面内で所定の規則に従って配置され、上記面内の任意の直線上における上記光学作用中心の配置が不規則であるものである（請求項２６）。

【００４５】かかる構成とすると、光学作用中心の配置が不規則であるので、光学作用を受けた回折光の干渉を解消することができ、かつ光学作用中心の配置が規則性を有するので、設計時に再現可能な光学特性を得ることができる。

【００４６】また、本発明に係る光学部材は、観測点方向に対する光学特性が面内で変化し、該光学特性が極大又は極小をなす光学作用中心の少なくとも一部が上記面内で所定の規則に従って配置され、上記面内の任意の互いに平行な直線上における上記光学作用中心の配置に互いに同じ規則性が現れないものである（請求項２７）。

【００４７】かかる構成とすると、光学作用中心の配置の規則性が特定方向に繰り返されないので、光学作用を受けた回折光の干渉を解消することができ、かつ光学作用中心の配置が規則性を有するので、設計時に再現可能な光学特性を得ることができる。

【００４８】また、上記光学特性が上記光学作用中心を中心とする微小領域と残りの領域との間で略不連続に変化し、かつ各領域において略一定値を有してなるものとしてもよい（請求項２８）。

【００４９】また、上記光学作用中心の少なくとも一部が略らせん状に配置されてなるものとしてもよい（請求項２９）。

【００５０】かかる構成とすると、任意の互いに平行な直線状断面における光学作用中心に互いに同じ規則性が現れない配置を容易に提供できる。

【００５１】この場合、上記らせんの中心からの距離の順に光学作用中心に番号ｎを付与したとき、ｎ番目とｎ＋１番目との間の中心角が１３７．５度の倍数である光学作用中心を含むものとしてもよく（請求項３０）、また、上記らせんの中心からの距離の順に光学作用中心に番号ｎを付与したとき、らせんの中心から光学作用中心までの距離がｎの平方根に比例する光学作用中心を含むものとしてもよい（請求項３１）。

【００５２】かかる構成とすると、隣接する光学作用中

心同士の距離をほぼ等しくすることができ、均一な光学特性を持つ光学部材を構成することができる。

【００５３】また上記の場合、上記光学作用中心の少なくとも一部が略同心円状に規則的に配置されてなるものとしてもよく（請求項３２）、また、上記光学作用中心の少なくとも一部が略放射状に配置されてなるものとしてもよく（請求項３３）、さらに、上記光学作用中心の少なくとも一部が略楕円らせん状又は略楕円放射状に配置されてなるものとしてもよい（請求項３４）。

【００５４】かかる構成とすると、光学作用中心の配置の規則性に基づく回折光の干渉を解消することができる。

【００５５】また、上記光学作用中心の少なくとも一部が、任意の平面座標上でｎを自然数とし上記座標の原点からの半径をｎの平方根、位相角を１３７．５度のｎ倍として得られた上記平面座標上の複数の点と相似な位置関係を有するように配置されてなるものとしてもい（請求項３５）。

【００５６】かかる構成とすると、各光学作用中心が面内に占める面積をほぼ同じにすることができ、隣接する光学作用中心の間の距離がほぼ一定に揃った規則的な配置を実現することができる。

【００５７】また、上記光学作用中心の少なくとも一部が、任意の平面座標上で同心円状に規則的に配置された複数の点を対称変換して得られた配置と相似な位置関係を有するように配置されてなるものとしてもよい（請求項３６）。

【００５８】また、上記光学作用中心の配置が、マトリクス状に繰り返し配置されてなるものとしてもよい（請求項３７）。

【００５９】また、上記光学特性が反射率であるとしてもよい（請求項３８）。

【００６０】かかる構成とすると、回折光の干渉を解消できかつ反射特性の設計再現性が良好な反射部材を提供できる。

【００６１】また、上記光学特性が屈折率であるとしてもよい（請求項３９）。

【００６２】かかる構成とすると、回折光の干渉を解消できかつ屈折特性の設計再現性が良好な屈折部材を提供できる。

【００６３】また、上記光学特性が透過率であるとしてもよい（請求項４０）。

【００６４】かかる構成とすると、回折光の干渉を解消できかつ透過特性の設計再現性が良好な透光部材を提供できる。

【００６５】また、本発明に係る光学部材は、観測点方向に対する光学特性が面内で複数の単位領域毎に変化し、全ての該単位領域の光学特性が同じであり、かつある該単位領域における該光学特性が極大又は極小をなす光学作用中心の少なくとも一部が該単位領域の面内で所定の規則に従って配置され、該単位領域の面内の任意の互いに平行な直線上における上記光学作用中心の配置に互いに同じ規則性が現れないものである（請求項４１）。

【００６６】かかる構成とすると、単位領域の面内のある直線上における光学作用中心に規則性が存在する場合は、単位領域の配置ピッチで、同じ規則性が現れることになるが、そのピッチが一定値以上でその配置の繰り返し頻度が小さい場合には、干渉がわずかとなり、実用上認識されないため、干渉による弊害を解消することができる。

【００６７】この場合、上記単位領域がマトリクス状に面内に形成されてなるものとしてもよい（請求項４２）。

【００６８】また、本発明に係る表示装置は、所定の情報を表示する表示手段と、該情報を表示するための光の光路上に配置され、該表示される情報を観測する方向に対する光学特性が面内で変化し、該光学特性が極大又は極小をなす光学作用中心の少なくとも一部が上記面内で所定の規則に従って配置され、上記面内の任意の直線上における上記光学作用中心の配置が不規則である又は任意の互いに平行な直線上における上記光学作用中心の配置に互いに同じ規則性が現れない光学部材とを備えたものである（請求項４３、４４）。

【００６９】かかる構成とすると、視認性及びその設計再現性が良好な表示装置を提供できる。

【００７０】また、本発明に係る照明装置は、光を発する発光手段と、該発せられる光の光路上に配置され、該表示される情報を観測する方向に対する光学特性が面内で変化し、該光学特性が極大又は極小をなす光学作用中心の少なくとも一部が上記面内で所定の規則に従って配置され、上記面内の任意の直線上における上記光学作用中心の配置が不規則である又は任意の互いに平行な直線上における上記光学作用中心の配置に互いに同じ規則性が現れない光学部材とを備えたものである（請求項４５、４６）。

【００７１】かかる構成とすると、視認性及びその設計再現性が良好な照明装置を提供できる。

【００７２】また、本発明に係る表示板は、光を発する発光手段と、該発せられる光の光路上に配置され、該表示される情報を観測する方向に対する光学特性が面内で変化し、該光学特性が極大又は極小をなす光学作用中心の少なくとも一部が上記面内で所定の規則に従って配置され、上記面内の任意の直線上における上記光学作用中心の配置が不規則であり又は任意の互いに平行な直線上における上記光学作用中心の配置に互いに同じ規則性が現れず、かつ上記光学作用中心が所定の表示パターン内に分布するよう配置されてなる光学部材とを備えたものである（請求項４７、４８）。

【００７３】かかる構成とすると、視認性及びその設計

再現性が良好な表示板を提供できる。

【００７４】また、本発明に係る波動部材は、波動の放射特性が面内で変化し、該放射特性が極大又は極小をなす波動作用中心の少なくとも一部が上記面内で所定の規則に従って配置され、上記面内の任意の直線上における上記波動作用中心の配置が不規則であるものである（請求項４９）。

【００７５】かかる構成とすると、放射する波動の回折による干渉を解消することができるとともに、その波動の放射特性の設計再現性が良好な波動部材を提供できる。

【００７６】また、本発明に係る波動部材は、波動の放射特性が面内で変化し、該放射特性が極大又は極小をなす波動作用中心の少なくとも一部が上記面内で所定の規則に従って配置され、上記面内の任意の互いに平行な直線上における上記波動作用中心の配置に互いに同じ規則性が現れないものである（請求項５０）。

【００７７】かかる構成としても、放射する波動の回折による干渉を解消することができるとともに、その波動の放射特性の設計再現性が良好な波動部材を提供できる。

【００７８】また、上記放射特性が上記波動作用中心を中心とする微小領域と残りの領域との間で略不連続に変化し、かつ各領域において略一定値を有してなるものとしてもい（請求項５１）。

【００７９】また、上記波動作用中心の少なくとも一部が同心円状に規則的に配置されてなるものとしてもよい（請求項５２）。

【００８０】かかる構成とすると、波動作用中心の配置の規則性による波動の干渉を解消することができる。

【００８１】また、上記波動が音波であり、それにより音響部材を構成してなるものとしてもよい（請求項５３）。

【００８２】かかる構成とすると、音の放射特性及びその設計再現性が良好な音響部材を提供できる。

【００８３】また、上記波動が電磁波であり、それにより電磁波部材を構成してなるものとしてもよい（請求項５４）。

【００８４】かかる構成とすると、電磁波の放射特性及びその設計再現性が良好な電磁波部材を提供できる。

【００８５】また、上記波動が振動であり、それにより振動部材を構成してなるものとしてもよい（請求項５５）。

【００８６】かかる構成とすると、振動の放射特性及びその設計再現性が良好な振動部材を提供できる。

【００８７】また、上記波動が電波であり、それにより電波部材を構成してなるものとしてもよい（請求項５６）。

【００８８】かかる構成すると、電波の放射特性及びその設計再現性が良好な電波部材を提供できる。

【００８９】

【発明の実施の形態】以下、本発明の実施の形態を図面を参照しつつ説明する。

実施の形態１

［反射板］図１は本発明の実施の形態１に係る反射板の構成を示す平面図、図２は図１のII－II断面図を示す。

【００９０】図２に示すように、反射板101は平坦な基板１上に凹凸層２が形成され、該凹凸層２上に反射膜３が形成されて構成されている。これにより、反射膜３が凹凸層２の表面の凹凸形状に従った凹凸形状を有するものとなっており、かつ反射膜３の表面が反射板101の表面を構成している。

【００９１】凹凸層２は感光性樹脂で構成され、フォトリソグラフィ法によって凹部を形成すべき部分を除去した後、該感光性樹脂をメルトフローすることによりその表面に滑らかな凹凸形状が形成されている。反射膜３は、反射率の高い金属膜で構成され、ここでは、厚み０．２μmのアルミニウム膜で構成されている。なお、反射膜３は、アルミニウムの他、銀等の反射率の高い金属で構成してもよい。

【００９２】図１には、反射膜３の凹凸形状のうち、凹部４が円で示されている。図１に示すように、凹部４は、基板１の主面上の所定の点Cを中心とする略らせん状の軌跡上に配置されている。この配置については、後で詳述する。従って、反射板101では、その表面の凹部４が所定の規則に従って配置されており、その一方、任意の直線状断面における表面形状は、図２に示すように、不規則な凹凸形状を有するものとなっている。

【００９３】以上のように構成された反射板101では、外光が入射すると、反射膜３の表面で反射される。その際、反射膜３の任意の直線状断面における表面形状が不規則であるので、反射光の回折による干渉が解消され、該反射光が白色化されて良好な反射特性が得られる。また、反射膜３の凹部４が一定の規則に従って配置されているので、設計変更等をする際にも、その規則に従って凹部４を配置することができるので、一定の反射特性を有する反射板101を設計することが可能である。この効果については、後で詳しく説明する。

［液晶表示素子］図３は本実施の形態に係る反射型液晶表示素子の構成を示す平面図、図４は図３のIV－IV断面図である。図３では液晶表示素子を透視的に描いてある。

【００９４】図３及び図４に示すように、反射型液晶表示素子（以下、単に液晶表示素子という）102は、所定の間隔で対向するように配置された反射板101’と対向基板（カラーフィルタ基板）103との間に液晶14が挟持され、対向基板103の外面に、位相差板12及び偏向板13がこの順に配置されて構成されている。

【００９５】反射板101’は、上述の本実施の形態に係る反射板である。但し、反射板101’は、ここでは、例

えば無アルカリガラスからなる基板１上に、ソース線ＳＬ、ゲート線ＧＬ、及びこれらに接続されたスイッチング素子６が形成され、このソース線ＳＬ、ゲート線ＧＬ、及びスイッチング素子６が形成された基板１上に凹凸層２及び反射膜（以下、画素反射膜という）３’が形成されて構成されている。ソース線ＳＬ及びゲート線ＧＬは基板１上にマトリクス状に形成され、そのソース線ＳＬとゲート線ＧＬとで区画された領域が画素201を構成している。そして、スイッチング素子６は、画素201毎に設けられている。スイッチング素子６は、ここでは、ＴＦＴ(Thin Film Transistor)で構成されている。画素反射膜３’は、画素201毎に区切られて形成され、凹凸層２を貫通するように形成されたコンタクトホール７を介してスイッチング素子６の端子６aに接続されている。つまり、画素反射膜３’は、画素201毎に配置され、反射板101’の金属反射層を構成するとともに画素電極を構成している。また、図３から明らかなように、画素反射膜３’は、その凹部４が各画素201毎に所定の点Ｃを中心とする略らせん状に配置されている。

【００９６】対向基板103は、例えば無アルカリガラスからなる基板11の内面に、カラーフィルタ10及び透明電極からなる共通電極９がこの順に形成されている。なお、符号10a, 10b, 10cは、それぞれ、Ｒ（赤）、Ｇ（緑）、Ｂ（青）の各原色の領域を示す。

【００９７】次に、以上のように構成された液晶表示素子102の動作を説明する。この液晶表示素子102では、外光が偏光板13側から入射し、該偏光板13、位相差板12、基板11、カラーフィルタ10、共通電極９、及び液晶14を順次通過し、画素反射膜３’の表面で反射して、上記各部材を逆の順に通過して偏光板13から外部に出射する。一方、ゲート線ＧＬに入力されるゲート信号により各画素201のスイッチング素子６が順次オンされ、これにタイミングを合わせてソース線ＳＬから映像信号が各画素201の画素反射膜３’に順次入力される。これにより、画素反射膜３’と共通電極９との間にその映像信号に応じた電圧が印加され、その電圧に応じて各画素201における外光の反射率が変化する。これにより、液晶表示素子102を観察する人の目に、上記映像信号に対応する映像が映る。この際、外光が画素反射膜３’で散乱されることにより、良好な視認性を得ることができる。

［反射板の設計方法］図１の反射板101及び図３の反射板101’の凹部４は、上述のように、所定の規則に基づいて、所定の点Ｃをらせんの中心とする略らせん状に、かつその中心から離れる方向に順に規則的に配置されたものであり、略同心円状の配置となっている。図５は、この規則に従った配置について示すものである。図５において、多数の点301の位置は、平面座標（極座標）によって表されている。そして、各点301は、ｎを自然数とするとき、その平面座標の原点を中心として、そこからの半径ｒがｎの平方根に比例し、位相角θが１３７．５度のｎ倍となるように位置している。図５にはｎ＝６まで番号を示している。より具体的には、１番目の点は、Ａを比例定数とするとき、ｒ＝Ａ×$\sqrt{1}$＝Ａ（μｍ）、θ＝１３７．５（度）、２番目の点は、ｒ＝Ａ×$\sqrt{2}$（μｍ）、θ＝２×１３７．５（度）、ｎ番目の点は、ｒ＝Ａ×$\sqrt{n}$（μｍ）、θ＝ｎ×１３７．５（度）、となるように位置している。図５に示すこの配置は、ひまわりの種等、自然界に見られる配置である。

【００９８】１３７．５度という角度は、フィボナッチ数列と呼ばれる理論から数学的に導かれ、この角度のとき、隣接する点301との間隔がほぼ等しく揃った規則的な配置にすることが可能である。また、中心からの距離をｎの平方根に比例するように配置することで、中心から周辺に向かって順に点301を配置したときに、各点301が上記平面座標上に占める面積をほぼ同じにすることができ、隣接する点301との間隔をほぼ等しく揃った配置にすることが可能である。

【００９９】図３の液晶表示素子102の画素反射膜３’の凹凸配置は、図１に示す領域202の内側と同じ凹凸配置であり、図５に示す方法で配置した複数の点を取り出して、これに相似な配置を画素201の領域に当てはめることにより得られたものである。このようなことから、図1の反射板101及び図３の反射板101’の凹凸配置は、らせんの中心Ｃからの距離の順に凹部４に番号ｎを付与したとき、ｎ番目のものとｎ＋１番目のものとの間の中心角が１３７．５度の倍数であり、らせんの中心からの距離がｎの平方根に比例する凹部４で構成されている配置である。

【０１００】この方法により凹凸を規則的に配置した場合、図２及び図４に示すように、反射板101, 101’の任意の直線状の断面において、同じ凹凸が繰り返し並ぶのではなくさまざまな形状が組み合わされた不規則な表面形状が形成できることを本件発明者は発見した。このように、任意の直線状の断面が不規則な表面形状を有する反射板101及び液晶表示素子102は、凹凸によって回折した反射光が干渉して強め合うことがなく、そのため、干渉を解消することができる。

【０１０１】なお、上記の比例定数ＡがＡ＝１（μｍ）の場合、隣接する凹部同士の間隔は、およそ１．９（μｍ）となる。比例定数Ａの値を任意に変化させることにより、隣接する凹部同士の間隔を任意に設計することが可能となる。以上のように、簡便な計算によって凹凸の配置を決定することができる。

【０１０２】なお、上記のように凹凸配置を画素201内に配置する際、画素201内の領域と画素201の周辺領域との境界近傍では、凹部が境界にまたがる場合がある。図３の液晶表示素子102の例では、凹部が画素201の境界にまたがるような場合には、原則として凹部を形成しないようにした。なお、このようにせず、境界にまたがって凹部を形成するようにしてもよい。

【０１０３】また、凹部４は、全てが上記の規則に従った点に配置される必要はなく、上記規則に従った凹部４の配置に加えて、その規則に従わない任意の点に凹部４を配置してもよい。図１４は、図１の配置を基に、点Ｃ付近で凹部４が疎になる箇所に、上記の規則に従わない凹部４ａを付加したものである。このように、規則に従った凹部４の配置以外の凹部４aを付加し、規則的に配置された凹部４と任意に配置された凹部４aとを混在させることもできる。このときにも、任意に配置された凹部４aに比べて、規則的に配置された凹部４の割合が多い方が好ましく、全ての凹部のうち少なくとも５割が規則的な配置に従うように凹部の配置を設計することが望ましい。

【０１０４】また、規則的な配置を基に、凹部を間引くことにより、凹部の数を減らして凹部の配置を設計してもよい。図１５は、図１の配置を基に、数個の凹部を除去したものである。凹部の数を減らした場合でも、同様に干渉を抑制した反射板の設計が可能である。

【０１０５】また、上記液晶表示素子102では、１つの、規則に従った配置（以下、規則配置という）のみを、１つの画素反射膜３’に配置したが、２つ以上の規則配置を組み合わせて、１つの画素反射膜３’を形成してもよい。図１６は、図３の画素反射膜３’に相当する領域の凹部の配置を示したものであり、画素反射膜３’の左右で異なる配置を組み合わせたものである。これによっても、上記と同様の効果を得ることができる。

【０１０６】また、らせんの中心は、かならずしも凹凸を配置する領域内にある必要はなく、図１７のように、らせんの中心Ｃが凹部４が配置される領域（図では画素反射膜３’に相当する領域を示している）中にない配置でもよい。

【０１０７】また、上記の例では、１つの画素反射膜３’に凹凸配置をあてはめたが、図１８のように、複数の画素反射膜３’にまたがって、１つの規則に基づく配置をあてはめてもよい。例えば、液晶表示素子のすべての画素反射膜３’について、凹凸配置を１つの中心を有するらせん状の配置としてもよい。

【０１０８】また、凹部の形状は、上記例では、円である場合を示したが、任意の多角形、すなわち、正三角形、二等辺三角形を含む任意の三角形、長方形、正方形、台形を含む任意の四角形でもよく、同様に、任意の五角形、六角形及び、それ以上の角を有する多角形でもよい。

【０１０９】また、反射板の延在面に対する凹凸形状の表面の傾斜角は５度～１０度程度に多く分布することが好ましい。また、凹部又は凸部の数は１０個以上とするのが好ましい。また、凹部又は凸部の数は、１０～３００個程度とするのが好ましく、凹部又は凸部の径は、５μｍ～５０μｍとするのが好ましい。

［反射板及び液晶表示素子の製造方法］図６は、本実施の形態に係る反射板の製造方法を示す図であって、(a)～(d)は各工程を示す工程別断面図である。

【０１１０】反射板を製造するには、まず、図６(a)に示すように、基板１上に２．０μｍの厚みでポジ型感光性材料からなる感光性材料２’を塗布し、その後、凹部を形成すべき箇所に透光領域15a、それ以外の部分に遮光領域15bがそれぞれ形成されたフォトマスク15によりマスク露光を実施し、それにより、感光性材料２’の上記透光領域15aに対応する部分を感光させる。

【０１１１】次いで、このマスク露光された基板１に現像を施し、それにより、図６(b)に示すように、感光性材料２’の上記感光部分に開口16を形成する。

【０１１２】次いで、この開口16が形成された基板１を、硬化前における感光性材料２’のガラス転移温度で加熱処理し、それにより、感光性材料２’をメルトフローさせて表面を丸めるとともに上記開口16を塞いで、図６(c)に示すような表面に凹凸を有する凹凸層２を形成する。ここで、メルトフローとは、加熱で膜が軟化することにより、膜の表面の角が丸まったり膜が基板上を流動する等、形状変化を起こす性質又は現象を指す。

【０１１３】次いで、この凹凸層２が形成された基板１を、感光性材料の硬化温度で焼成して、該凹凸層２を硬化させる。

【０１１４】次いで、凹凸層２上に高反射率の金属からなる反射膜３を所定の厚みに形成にする。これにより、反射板101が得られる。

【０１１５】次に、本実施の形態に係る液晶表示素子の製造方法を図４を用いて説明する。液晶表示素子102を製造するには、まず、周知のフォトリソグラフィ法により、ガラス基板１上にソース線ＳＬ、ゲート線ＧＬ、及びスイッチング素子６をそれぞれ形成する。次いで、このソース線ＳＬ、ゲート線ＧＬ、及びスイッチング素子６が形成された基板１上に、上記と同様にして凹凸層２を形成する。その後、凹凸層２上に高反射率の金属膜を形成し、その金属膜を、フォトレジストをマスクに用いてエッチングすることにより、画素201毎に区切られた反射膜３’を形成するとともに、凹凸層２の上記開口部の塞がらずに残った部分にコンタクトホール７を形成する。これにより、反射板101’が得られる。

【０１１６】一方、周知のフォトリソグラフィ法により、ガラス基板11上にカラーフィルタ10及び共通電極９を順次形成して、対向基板103を得る。

【０１１７】次いで、反射板101’と対向基板103とを所定の間隙を有するようにして貼り合わせ、その間隙に液晶14を注入して封止する。次いで、対向基板103の外側に、位相差板12及び偏向板13を順次貼り付ける。これにより、液晶表示素子102が得られる。

【０１１８】以上の反射板101及び液晶表示素子102の製造方法によれば、メルトフローを用いたフォトリソグラフィ法により、容易に反射板101, 101’の表面の凹凸を

形成できる。

【０１１９】なお、ここで用いたフォトマスク15は、上述の凹凸配置に従って、凹部に相当する部分に所定の径の透光領域15aを形成し、それ以外の部分を遮光領域15bとしたものである。これにより、反射板101, 101'の表面に、上記フォトマスク15の透光領域と相似な位置に凹部４を形成することができた。なお、凹凸層２を形成する材料としてネガ型感光性材料を用いた場合には、上記透光領域及び遮光領域を反転した構成のフォトマスクを用いる。

【０１２０】このようにフォトリソグラフィ法によれば、露光の際のフォトマスク15のマスクパターンに依存して、凹凸配置が決まるため、フォトマスク15の設計が反射板101, 101'の反射特性を決める最も重要な要素となる。本実施の形態では、反射板101, 101'の反射特性を左右するフォトマスク15の設計を上記のように規則的に行うことにより、この配置がフォトマスクの設計変更に際して変わることがなく、所定の反射特性の反射板を容易に設計することが可能となった。

実施の形態２

本発明の実施の形態２は、略らせん状配置における凹部の配置角度を変えた例を示したものである。すなわち、実施の形態１では、凹部４を１３７．５度の角度毎に配置したが、１３７．５度の角度の代わりに他の角度に設定して凹凸配置を設計することもできる。この角度を１４２度とした場合の例を図７に示す。また、図７のVIII－VIII断面を図８に示す。この場合、反射板101の凹部４は、図７に示すように略らせん状の配置となり、任意の直線状断面における表面形状は、図８に示すように、異なる形状を持った凹凸が連なるものとなる。このため、反射光の干渉が発生することがなく、実施の形態１と同様の効果を得ることができる。

実施の形態３

本発明の実施の形態３は、略らせん状配置における凹部の配置の角度を変えた他の例を示したものである。実施の形態１では凹部４を１３７．５度の角度毎に配置したが、１３７．５度の代わりに１５度毎に凹部４を配置したものを図９に示す。この場合、略放射状に凹部４が並んだ配置が得られる。図９のX－X断面を図１０に示す。また、同じくXI－XI断面を図１１に示す。この凹凸配置においても、実施の形態１と同様に反射光の干渉を抑制することができた。本実施の形態の場合は、実施の形態１及び２とは異なり、図１０に示すX－X断面だけを見ると凹凸のピッチが比較的揃っており（ある規則性を持って繰り返されている）、反射光の干渉が発生する可能性が考えられる。しかし、図１１に示す、X－X断面に平行なXI－XI断面では、X－X断面とは異なる形状の断面となっている。このような場合は、特定の断面を見ると同じ凹凸が規則性を持って揃っているにも関わらず、反射板101全体としては、人間の目に干渉として認識されない。これは、以下の理由によるものである。

【０１２１】つまり、規則的な凹凸に基づく回折光の干渉は、反射板101を見たとき、面状に観察される。このため、反射板101を見る人間にその干渉が認識されるためには、１）直線状断面における凹凸の断面形状が規則的であること、２）上記断面と平行な断面で同じ規則性が繰り返し現れること、の２つの条件が必要である。本実施の形態では、図１０に示すX－X断面と図１１に示すXI－XI断面とで凹凸の断面形状が異なるように、上記２）を満たさないものである。すなわち、反射面内の一方向に同じ規則性を繰り返す凹凸配置がない反射板では、干渉を認識することはできず、凹凸配置に基づく干渉を解消することができる。また、このような凹凸配置を、一方向に繰り返してなる配置では、その繰り返しのピッチで、同じ規則性が現れることになるが、そのピッチが一定値以上でその繰り返しの頻度が小さい場合は、干渉がわずかとなり、実用上認識されない。この干渉として認識されないピッチは、本件発明者の経験では、５０μm以上である。そして、高精細化された画像表示装置においては、画素の配置ピッチは５０μmであるので、このような凹凸配置でも、画像表示装置の反射板に十分適用することができる。

実施の形態４

本発明の実施の形態４は、上述の凹部の配置をその不規則性を失わないように変形した例を示したものである。実施の形態１～３では、凹部が略らせん状、又は略放射状に配置された例を示したが、これらの配置を特定の軸方向に縮小又は拡大してなる略楕円らせん状、又は略楕円放射状に凹部を配置した構成においても同様の効果を得ることができる。図１２に、略楕円らせん状の配置、図１３に略楕円放射状の配置を示す。

【０１２２】なお、上記実施の形態１～４では、全て、凹凸形状のうちの凹部の配置について示したが、凹部に限らず、凸部を同様の方法により配置し、反射板及び反射型液晶表示素子を構成した場合でも、同様の効果を得ることができる。

【０１２３】また、上記実施の形態１～４では、略らせん状、略放射状、略楕円らせん状、略楕円放射状の配置について示したが、これらの配置以外でも、反射板の任意の直線の断面における表面形状が不規則である反射板では、干渉を解消することができ、実施の形態１～４と同様の効果を得ることができる。また、特定の断面を見ると同じ凹凸が規則性を持って揃っていても、１）直線状断面における凹凸の断面形状が規則的であること、２）上記断面と平行な断面で同じ規則性が繰り返し現れること、の２つの条件を満たさない反射板では、干渉を解消することができ、実施の形態１～４と同様の効果を得ることができる。

【０１２４】さらに、上記実施の形態１～４では、実施の形態１のらせんの中心からの距離に基づいて凹部又は

凸部を配置する配置（以下、基本配置という）を基礎とした、略らせん状、同心円状、及び放射状の配置を示したが、略らせん状、同心円状、及び放射状の配置は、この基本配置に基づかなくても、通常、実用に供し得るものである。略らせん状、同心円状、及び放射状の配置は、半径方向に規則的に配置された場合、それに平行な直線上では規則的な配置にはならず、上記１）、２）の干渉の条件を満たさない。また、それらの配置の中心点を中心に対称に配置された場合、その中心点を中央に挟む平行な２直線上の配置は同じになるが、この場合でもその配置は一般的には規則的にならず、また、たとえ、規則的になったとしても、それらの間隔が離れているため、干渉を生じ難いからである。

実施の形態５

図２１は本発明の実施の形態５に係る反射型液晶表示装置の構成を示すブロック図である。図２１に示すように、本実施の形態に係る反射型液晶表示装置400は、実施の形態１の液晶表示素子102のソース線ＳＬ及びゲート線ＧＬをそれぞれソース駆動回路402及びゲート駆動回路403によって駆動し、ソース駆動回路402及びゲート駆動回路403を信号処理回路401によって制御するよう構成したものである。このような構成とすると、液晶表示素子102が、ゲート駆動回路403及びソース駆動回路402により駆動され、画素反射膜に入射しそこで反射される外光の透過率を変化させる。これにより、液晶表示装置400を観察する人の目に、ソース線ＧＬの映像信号に対応する映像が映る。その際、外光が画素反射膜で散乱されることにより、良好な視認性を得ることができる。よって、良好でかつ再現可能な反射特性を有する反射型液晶表示装置を実現することができる。また、実施の形態１の凹部配置についての各変形例を有する反射板及び実施の形態２～４の反射板を用いて反射型液晶表示装置を構成してもよく、同様の効果が得られる。

実施の形態６

上記実施の形態１～５では、反射板の表面の凹凸によって反射光が回折し、規則的な凹凸の配置によってその回折した光が干渉する現象を抑制することにより、良好な視認性が得られた。この回折した光の干渉は、入射した光を反射、透過、屈折等する平面からなる場合にも生じる。従って、本発明は、反射板の凹凸だけでなく、屈折率や透過率等が平面内で分布している光学部材において、この分布が同じような態様で繰り返すように配置されたときに、回折した光が干渉するのを抑制することにも有効である。

【０１２５】例えば、光を散乱させる光学部材、いわゆる散乱膜や、透明な部材に光を遮光する微小領域を配置して光を減衰させる光学部材に適用することができる。

（実施例１）本発明の実施例１は、光を散乱させる光学部材を例示したものである。図２２は本実施例に係る光学部材の構成を示す断面図である。

【０１２６】図２２に示すように、本実施例に係る光学部材503は、互いに屈折率が異なる２種類の透明な材質からなる上層502と下層501とで構成されている。そして、上層502と下層501との界面504が、実施の形態１～４の反射板の表面と同様の凹凸形状を有している。また、上層502の上面及び下層501の下面501aは、共に平坦でかつ互に平行に形成されている。

【０１２７】上層502及び下層501は、ガラス、窒化膜、インジウム錫酸化物（ＩＴＯ）や、アクリル樹脂、エポキシ樹脂等の透明樹脂等透明な物質の中から屈折率が異なるものを適宜に選択して使用することができる。本実施例では、下層501がガラス、上層502がアクリル樹脂でそれぞれ構成されている。この光学部材503では、光が、上層502の上面502a及び下層501の下面501aのいずれかに入射すると、上層502と下層501との界面504が、その凹凸形状によって、上層502の上面502a及び下層501の下面501aに対して傾斜した面を有しているので、その入射した光が界面504で屈折して散乱する。

【０１２８】このように、界面504の傾斜によって、光学部材503の観測点方向に対する光学特性（ここでは散乱特性）は、該光学部材503の延在面内で変化し、大小の分布を持つ。そして、その凹凸による界面504の傾斜に従って光学特性が極大又は極小となる点が光学部材503の延在面内に配置される。本明細書では、面内で光学特性が極大又は極小の極値をとる点を光学作用中心と呼ぶ。光学作用中心は、面内全体の最大値又は最小値をとる点ではなく、特性の分布が山又は谷のように分布している部分の極値をとる点である。本実施例では、図２２の断面図における界面504の凹部の底が光学作用中心505である。光学作用中心505を規則的に配置した場合には、図１９及び図２０の従来例に示す凹凸を有する反射板と同じように、回折による光の干渉が発生し、特定の方向から見たときに、光が強く見える、又は色づいて見えるという不具合が生じる。しかし、その不具合を解消すべく光学作用中心をランダムに配置しようとすると、その配置に規則性がない場合には、設計者に依存して光学部材の特性が変化する可能性がある。そこで、本実施例の光学部材503の場合にも実施の形態１～４の反射板と同じように、光学作用中心を平面内で所定の規則に従って配置し、平面内の任意の直線上における光学作用中心の配置を不規則とすることで、回折光の干渉を抑制し、良好な散乱特性を得られるとともに、再現性のある設計を行うことができる。

【０１２９】また、本実施例の光学部材を、平坦な金属反射板を有する反射型表示装置の表面に配置することにより、金属反射板による光源の映りこみを抑制し、良好な散乱特性を有する反射型表示装置を提供することができる。

【０１３０】図２３は、図２２の光学部材の製造方法を示す図であって、(a)～(d)は各工程を示す工程別断面図

である。

【０１３１】光学部材を製造するには、まず、図２３(a)に示すように、平坦なガラス基板501'上にポジ型のフォトレジスト506 を塗布し、その後、凹部を形成すべき箇所に透光領域15a、それ以外の部分に遮光領域15bがそれぞれ形成されたフォトマスク15によりマスク露光を実施し、それにより、フォトレジスト506の上記透光部15bに対応する部分を感光させる。

【０１３２】次いで、このマスク露光されたガラス基板501'に現像を施し、それにより、図２３(b)に示すように、フォトレジスト506の上記感光部分に開口507を形成する。

【０１３３】次いで、このフォトレジスト506をマスクとして、フッ酸によりガラス基板501'をエッチングすることにより、図２３（ｃ）に示すように、ガラス基板501'の表面を溶かして凹凸を形成して、下層501を得る。

【０１３４】次いで、フォトレジスト506を剥離し、その後、下層501上にアクリル樹脂を塗布し硬化させて、図２２（ｄ）に示すように、上層502を形成する。これにより、光学部材503が得られる。このようにフォトリソグラフィ法によって、本実施例の光学部材503を容易に得ることができる。

【０１３５】上記マスク露光を行うためのフォトマスク15は、遮光領域15b又は透光領域15aの配置を、任意の平面座標上で同心円状の規則的な配置と相似な位置関係となるよう設計する。こうすることで、光学部材の光学作用中心を同心円状の規則的な配置とすることができ、本発明の効果を得ることができる。そして、光学作用中心の配置は、任意の平面座標上で同心円状の配置を有する複数の点を対称変換して得られた配置と相似な位置関係を持つものでもよい。ここで、対称変換とは、ある軸の回りの一定の角度の回転、ある直線での鏡映、及び平行移動のいずれかの方法をいう。又は、これらの対称変換を組み合わせた変換を行ったものをいう。

【０１３６】光学作用中心の配置は、より具体的には、実施の形態１～４に示す凹部又は凸部の配置と同様に略同心状、略らせん状、略放射状、略楕円らせん状、略楕円放射状とすることができる。また、らせんの中心からの距離の順に番号ｎを付与したとき、ｎ番目とｎ＋１番目との間の中心角が１３７．５度の倍数であり、らせんの中心から光学作用中心までの距離がｎの平方根に比例した位置関係を含む配置とすることができる。

（実施例２）図２４は本発明の実施例２に係る光学部材の構成を示す断面図である。図２４において、本実施例に係る光学部材603は、透明で平坦な基板601上に、所定位置に多数の微小な開口部604を有するように遮光層602が設けら、それにより、開口部604に入射光を透過する多数の微小透光領域が形成されるとともにそれ以外の部分に入射光を遮光する遮光領域が形成されて構成されている。これにより、光学部材603に光が入射すると、その一部だけが微小透光領域604を通過し、他は遮光領域で遮られるので、その光量が減衰する。このような光学部材603は、光源の光量が強いとき、これを減衰させるために、光源の前に配置される。この光学部材603では、微小透光領域604の面積に応じて入射光を透過させることができる。

【０１３７】ここで、微小透光領域604が等間隔で規則的に配置されている場合には、微小透光領域604の周辺で回折した光が干渉して、凹凸を有する反射板の場合と同様に、特定の方向に光が強く透過したり、透過した光に色づきが発生してしまう。そこで、微小透光領域604の光学作用中心605を所定の規則に従って基板601の主面上に配置するとともに、その際に該主面内の任意の直線上における上記光学作用中心605を不規則に配置することにより、回折光の干渉が抑制され、色づきのない良好な透過光を得ることができる。

【０１３８】また、以上の説明から明らかなように、本実施例における光学特性は透過率である。また、遮光層602は、フォトリソグラフィ法により、容易に形成することができる。このとき、フォトマスクを、実施例１と同様の方法で設計することにより、光学部材の光学作用中心を本発明の効果が得られるように配置にすることができる。

【０１３９】また、図２４において、微小透光領域604に代えて、入射光を反射する反射膜を備えた微小領域を形成することにより、入射した光を、その光量を減衰させて反射する光学部材を構成することができる。

【０１４０】以上の実施例１及び２のように、光学特性として屈折率、透過率、反射率等がその延在面内で分布を持つ光学部材において、それぞれの光学特性の光学作用中心を本発明に従って配置することにより、回折光の干渉を抑制する効果を得ることができる。

実施の形態７

本発明の実施の形態７は、実施の形態６の光学部材を応用した各種の光学機器を例示したものである。すなわち、実施の形態６の光学部材に、表示を行うための表示手段を付加することにより、反射型液晶表示装置や、ＥＬ表示装置のような表示装置を提供することができる。また、その光学部材に発光手段を付加することにより、面発光を行う照明装置を提供することができる。さらに、その光学部材において、表示するパターン内に光学作用中心が分布するよう構成し、かつ発光手段を付加することにより、電光表示板や交通標識等の表示板を提供することができる。以下、これを具体的に例示する。

（実施例３）図２５は本発明の実施例３に係る表示装置としての反射型液晶表示装置の構成を示すブロック図である。図２５に示すように、本実施例に係る反射型液晶表示装置901は、実施の形態１の液晶表示素子（図４参照）において反射膜３'を平坦に形成してなる反射型液

晶表示素子902を用い、その反射型液晶表示素子902の前面に実施の形態６の実施例１の光学部材503を配置するとともに、そのソース線ＳＬ及びゲート線ＧＬをそれぞれソース駆動回路402及びゲート駆動回路403によって駆動し、ソース駆動回路402及びゲート駆動回路403を信号処理回路401によって制御するよう構成したものである。このような構成とすると、反射型液晶表示素子902に入射した外光がその平坦な反射膜で鏡面反射されるが、その入射及び反射の際に光学部材503により散乱されるため、広視野角特性を有するものとなる。しかも、その広視野角特性が設計の再現性を有するものとなる。

（実施例４）図２６は本発明の実施例４に係る照明装置の構成を示す模式図である。図２６に示すように、本実施例に係る照明装置1001は、ランプ等の非面状光源からなる発光手段1002の前に実施の形態６の実施例１の光学部材503を配置したものである。このような構成とすると、発光手段1002から放射された光が光学部材503を通過する際に散乱されるので、良好な拡散特性で面発光を行う照明装置を提供することができる。しかも、その面発光の特性が設計の再現性を有するものとなる。

（実施例５）図２７は本発明の実施例５に係る表示板の構成を示す正面図である。図２７において、本実施例に係る表示板1101は、発光手段1102の前に実施の形態６の実施例２の光学部材603が配置され、その光学部材603において、表示パターン1103内に光学作用中心が分布するよう構成されている。このような構成とすると、発光手段1102から出射された光が光学部材603のパターン1103内に分布する微小透光領域を透過し、それにより、表示パターン1103が発光して見える。よって、色づき等の生じない表示板を提供することができる。しかも、その表示パターンの発光特性が設計の再現性を有するものとなる。

実施の形態８

以上の実施の形態１～７では、本発明の光学機器への適用例を示したが、本発明は、回折した光の干渉を抑制するものであるので、波動であれば、光に限らず、音波、電磁波、振動波等の別を問わずに有効である。よって、これらにも本発明を適用した音響部材、電波部材、電磁波部材、振動部材を構成することができる。すなわち、本発明の構成により、特定の周期又は周波数の波が強めあうのを抑制し、波が反射又は透過するときに均一な特性を呈する部材を提供することができる。また、本明細書では、実施の形態６で定義した光学作用中心という概念を広げて波動の作用中心という概念を用いる。ここで、波動の作用中心とは、面内で波動に関する特性が極大又は極小の極値をとるその面内における点をいう。従って、また、波動が、音響、電波、電磁波、振動である場合は、波動の作用中心は、それぞれ、音響作用中心、電波作用中心、電磁波作用中心、振動作用中心を指す。また、波動に関する特性とは、具体的には、波動の反射、屈折、透過等の特性を指す。以下、これを具体的に例示する。

（実施例６）図２８は本発明の実施例６に係る音響部材の構成を示す正面図である。図２８に示すように、本実施例に係る音響部材1111は、表面が音を吸収する吸音材の表面に、音を反響する微小反響領域1112が形成されて構成されている。この音響部材1111では、微小反響領域1112の面積に依存して、音が反響する程度を制御することができる。この微小反響領域の音響作用中心の配置を、実施の形態６に示す光学作用中心と相似な配置とすることで、特定の周波数の音が強め合うのを抑制し、かつ均一な音響特性を有する音響部材を提供することができる。音響室の壁面等に音響部材を設けることにより、良好な音響室を構成することができる。

（実施例７）波動のうち、電波、電磁波、振動においても、特定の観測方向に対し、ある周波数の波が強め合うために障害が起こる場合がある。例えば、電波では、放送設備の受信が交錯する受信障害、電磁波では、電磁波に対する感度で測定を行う撮像素子の感度障害、振動では、特定の方向に対する振動の強い伝播等の障害等である。本発明のように異なる特性を有する領域又は特性の分布を、所定の規則に基づいて配置する本発明の構成により、波が強め合うことによる障害を抑制し、かつ均一な波動特性を有する部材を提供することができる。

【０１４１】図２９は本発明の実施例７に係る電磁波部材の構成を示す正面図、図３０は本発明の実施例７に係る振動部材の構成を示す正面図、図３１は本発明の実施例７に係る電波部材の構成を示す正面図である。これらの図において、電磁波部材1121、振動部材1131、電波部材1141は、それぞれ、微小電磁作用領域1122、振動作用領域1132、微小電気作用領域1142がその延在面内に形成されている。微小電磁作用領域1122、微小振動作用領域1132、微小電気作用領域1142は、それぞれ、電磁波、振動、電波に関する反射率、透過率、屈折率、放射強度等の特性が各部材1121, 1131, 1141の延在面内において山又は谷状に変化する領域、つまり極大点近傍領域又は極小点近傍領域である。これら微小電磁作用領域1122、微小振動作用領域1132、微小電気作用領域1142の作用中心の配置が、実施の形態６に示す光学作用中心と相似な配置となっている。

【０１４２】なお、上記実施の形態１～８では、反射板、光学部材、及び波動部材は、その形状が平面状である場合を説明したが、これらが曲面状であっても構わない。つまり、波源となる部材の曲率がその波動の波長に比して大きい場合には、波の回折による干渉が生じるので、このような場合にも、波源となる部材が平面状である場合と同様に本発明を適用することができる。

【０１４３】

【発明の効果】本発明は以上の形態により実施され、放射する波動の干渉を抑制することが可能でかつ一定の放

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射特性を有する２次元形状の波動放射部材を設計することが可能な反射板及びその製造方法、反射型液晶表示装置及びその製造方法、光学部材、表示装置、照明装置、表示板、並びに波動部材を提供できるという効果を奏する。

【図面の簡単な説明】

【図１】本発明の実施の形態１に係る反射板の構成を示す平面図である。

【図２】図１のII－II断面図である。

【図３】本発明の実施の形態１に係る反射型液晶表示素子の構成を示す平面図である。

【図４】図２のIV－IV断面図である。

【図５】図１及び図３の反射板の凹部の規則に従った配置を示す図である。

【図６】図１の反射板の製造方法を示す図であって、(a)～(d)は各工程を示す工程別断面図である。

【図７】本発明の実施の形態２に係る反射板の構成を示す平面図である。

【図８】図７のVIII－VIII断面図である。

【図９】本発明の実施の形態３に係る反射板の構成を示す平面図である。

【図１０】図９のX－X断面図である。

【図１１】図９のXI－XI断面図である。

【図１２】本発明の実施の形態４に係る反射板の一構成例を示す平面図である。

【図１３】本発明の実施の形態４に係る反射板の他の構成例を示す平面図である。

【図１４】本発明の実施の形態１の反射板の凹部配置の変形例を示す平面図である。

【図１５】本発明の実施の形態１の反射板の凹部配置の他の変形例を示す平面図である。

【図１６】本発明の実施の形態１の反射型液晶表示装置の画素反射板の凹部配置の変形例を示す平面図である。

【図１７】本発明の実施の形態１の反射型液晶表示装置の画素反射板の凹部配置の他の変形例を示す平面図である。

【図１８】本発明の実施の形態１の反射型液晶表示装置の画素反射板の凹部配置のさらなる変形例を示す平面図である。

【図１９】従来の反射板の凹凸配置の一例を示す平面図である。

【図２０】図１９のXX－XX断面図である。

【図２１】本発明の実施の形態５に係る反射型液晶表示装置の構成を示すブロック図である。

【図２２】本発明の実施の形態６の実施例１に係る光学部材の構成を示す断面図である。

【図２３】図２２の光学部材の製造方法を示す図であって、(a)～(d)は各工程を示す工程別断面図である。

【図２４】本発明の実施の形態６の実施例２に係る光学部材の構成を示す断面図である。

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【図２５】本発明の実施の形態７の実施例３に係る表示装置としての反射型液晶表示装置の構成を示すブロック図である。

【図２６】本発明の実施の形態７の実施例４に係る照明装置の構成を示す模式図である。

【図２７】本発明の実施の形態７の実施例５に係る表示板の構成を示す正面図である。

【図２８】本発明の実施の形態８の実施例６に係る音響部材の構成を示す正面図である。

【図２９】本発明の実施の形態８の実施例７に係る電磁波部材の構成を示す正面図である。

【図３０】本発明の実施の形態８の実施例７に係る振動部材の構成を示す正面図である。

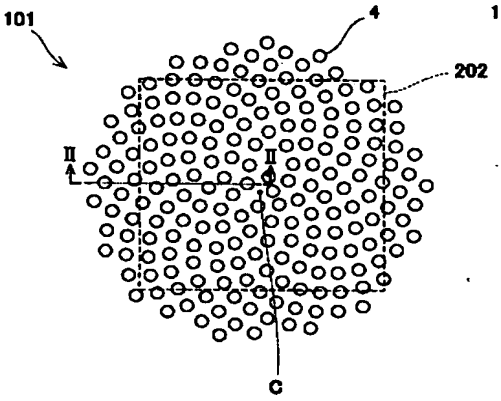
【図３１】本発明の実施の形態８の実施例７に係る電波部材の構成を示す正面図である。

【符号の説明】

1　基板
2　凹凸層
3　反射膜
3’画素反射膜
4，4a　凹部
6　スイッチング素子
6a　接続端子
7　コンタクトホール
9　共通電極
10　カラーフィルタ
11　基板
12　位相差板
13　偏光板
14　液晶
15　フォトマスク
15a　透光領域
15b　遮光領域
16　開口
101，101’　反射板
102，902　反射型液晶表示素子
103　対向基板
201　画素
202　画素反射膜に相当する領域
400，901　反射型液晶表示装置
401　信号処理回路
402　ソース駆動回路
403　ゲート駆動回路
501　下層
501’　ガラス基板
501a　下層の下面
502　上層
502a　上層の上面
503，603　光学部材
504　界面

505, 605　光学作用中心
506　フォトレジスト
507　開口
601　基板
602　遮光層
604　微小透光領域
1001　照明装置
1002　発光手段
1101　表示板
1103　表示パターン
1111　音響部材
1112　微小反響領域
1121　電磁波部材
1122　微小電磁作用領域
1131　振動部材
1132　微小振動作用領域
1141　電波部材
1142　微小電気作用領域
C　センタ
GL　ゲート線
SL　ソース線

【図１】



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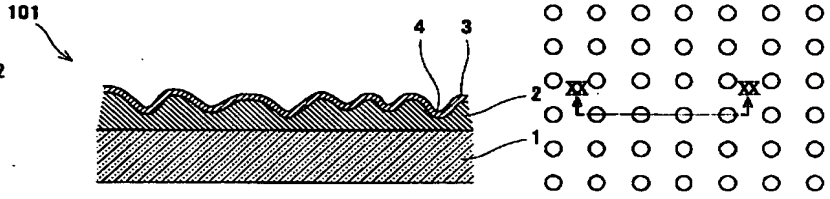
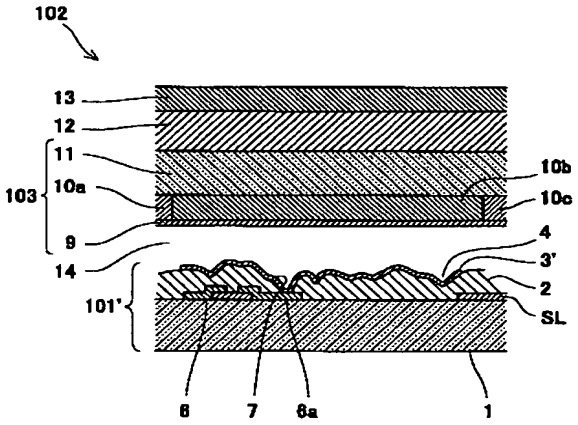


【図１９】

【図４】



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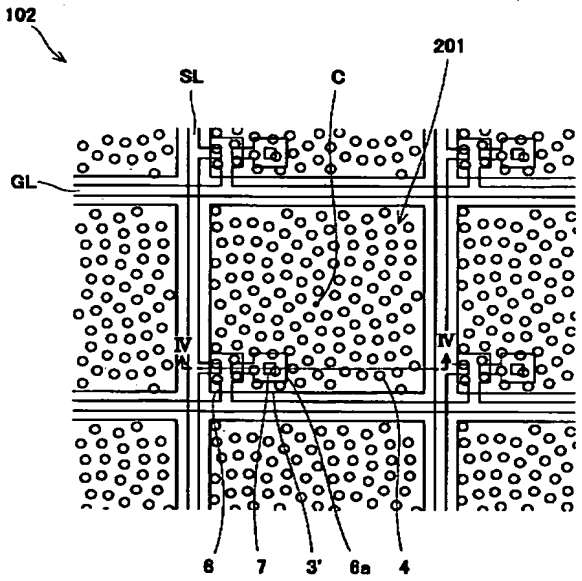

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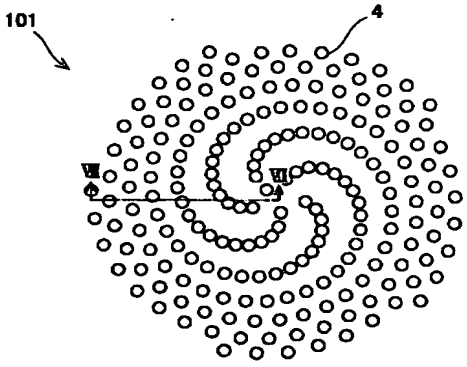

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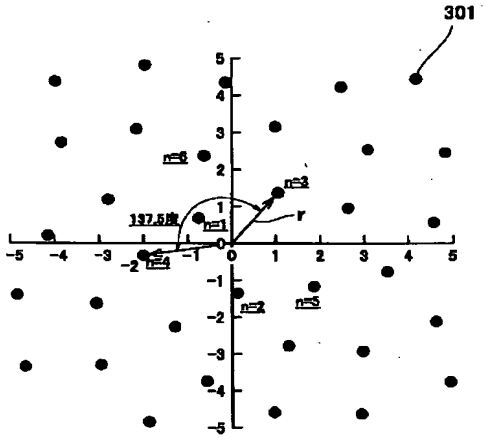

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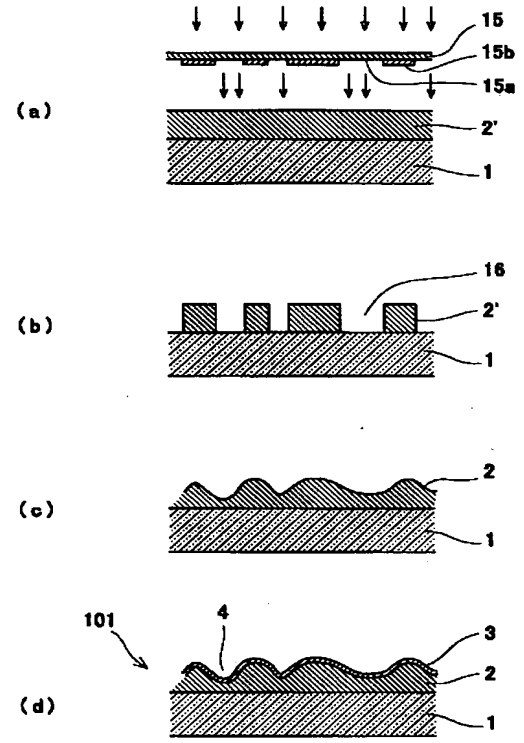

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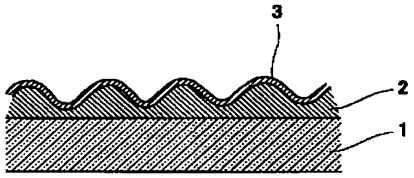

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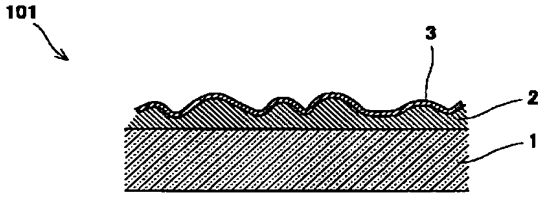

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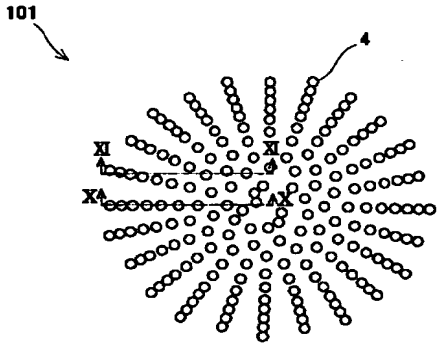

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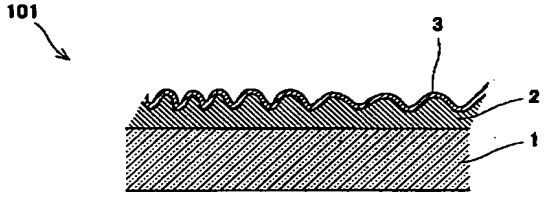

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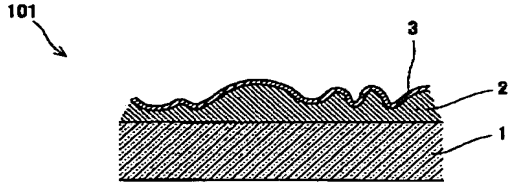

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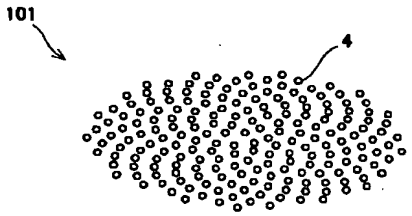

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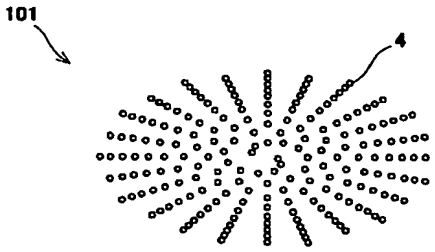

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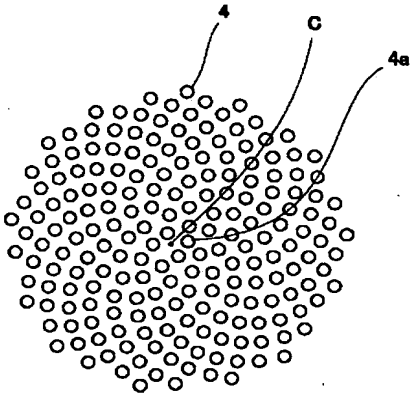

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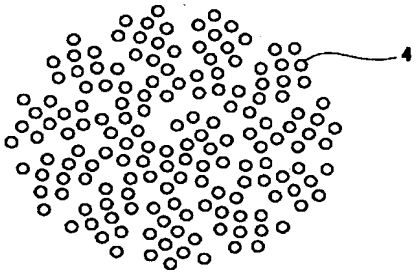

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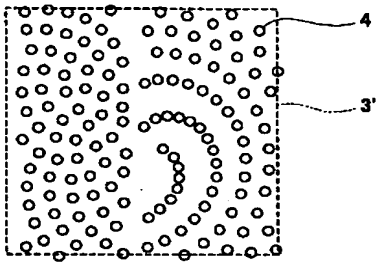

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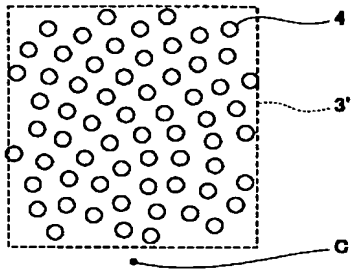

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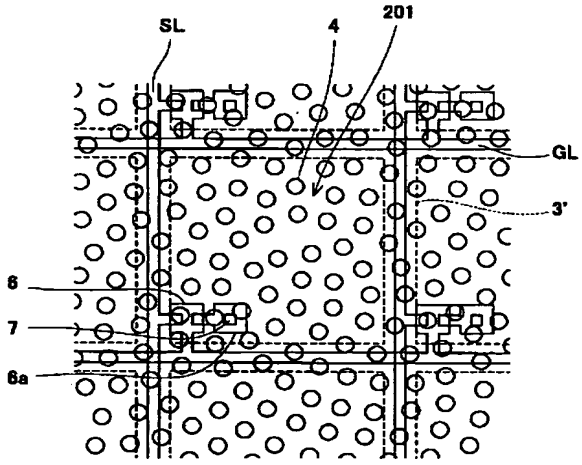

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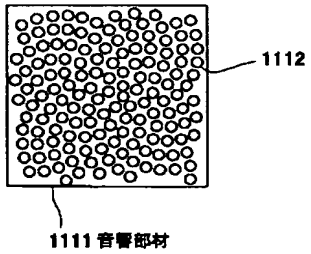

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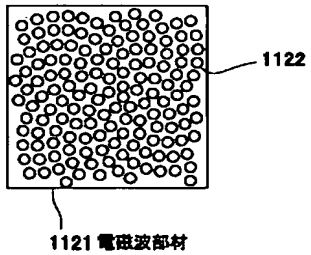

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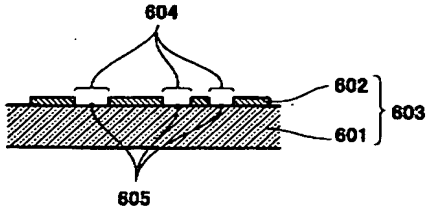

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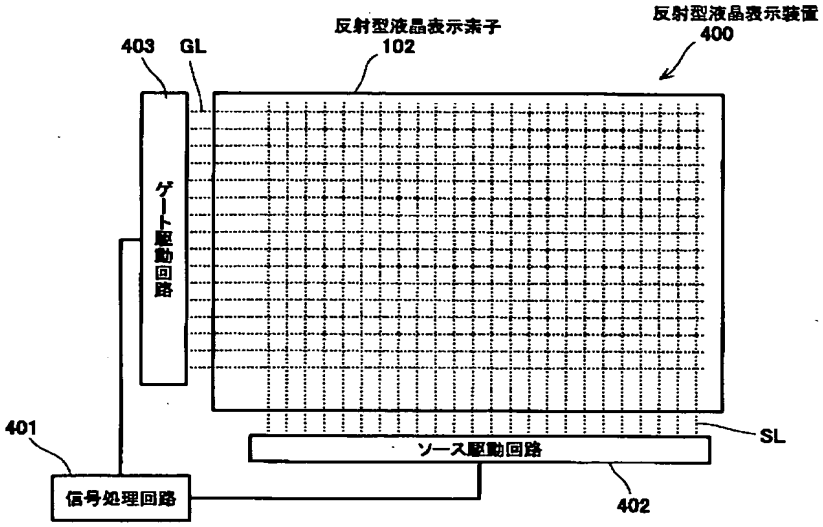

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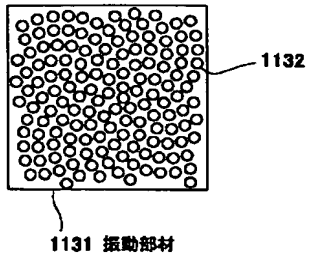

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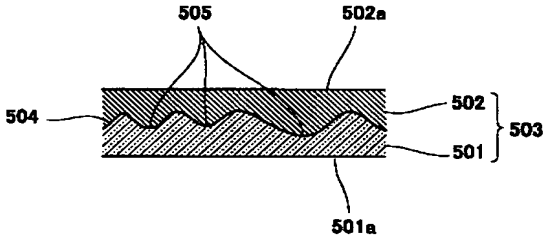

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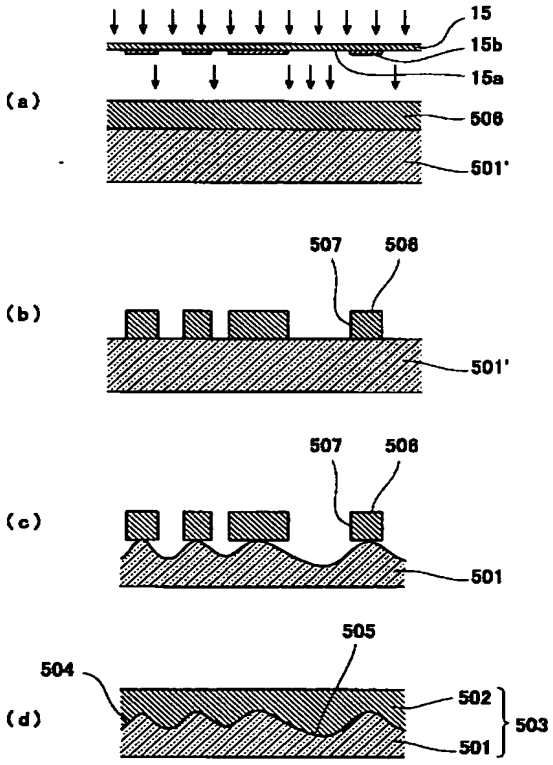
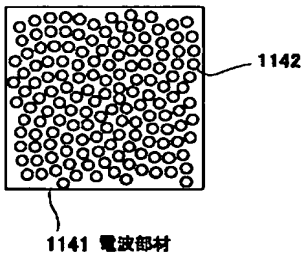


【図３１】



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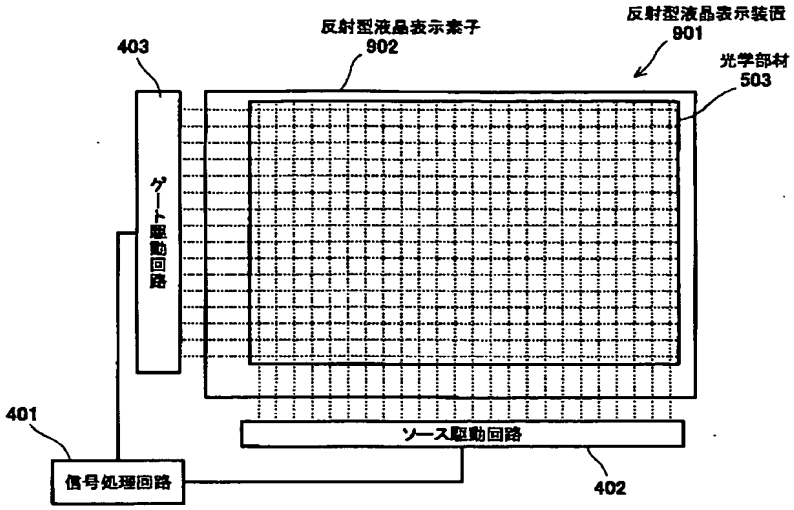
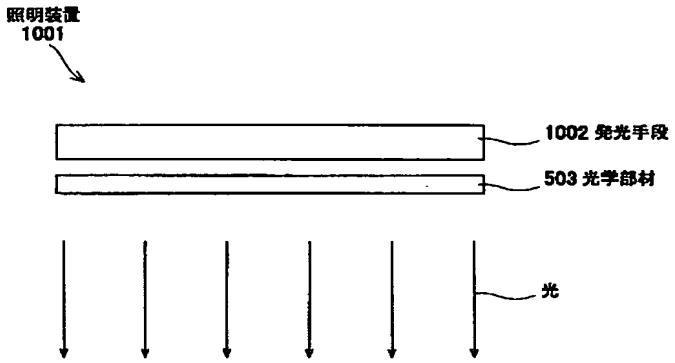
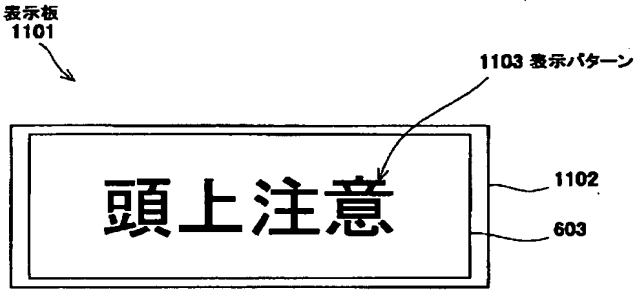

反射型液晶表示素子
902
反射型液晶表示装置
901
403
光学部材
503
ゲート駆動回路
401
ソース駆動回路
信号処理回路
402

【図２６】


照明装置
1001
1002 発光手段
503 光学部材
光

【図２７】


表示板
1101
1103 表示パターン
頭上注意
1102
603

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